Enhancing Student Learning Outcomes in Asynchronous Online Discussion

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I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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Christina Klisc

In loving memory of

my mother, Frances, who taught me…

girls can do anything

my brother, John, who taught me …

I can do anything

Abstract

When the asynchronous online discussion (AOD) environment was first introduced there was much enthusiasm about the potential of this new discussion space for enhancing student learning. However, after over two decades of AOD use, there is still concern about the realisation of the anticipated benefits, especially those associated with high order thinking skills such as critical thinking.

Research aimed at findings ways to enhance student learning outcomes in AOD has examined many different factors and conditions. Though there has been consistency in the findings of the research within many areas, at the same time there are still unresolved issues relating to the use of assessment, the type of instructor support and how an AOD should be designed and implemented. The aim of the research described in the thesis was to investigate how student learning outcomes may be enhanced in AOD, by investigating the conditions conducive to quality discussion and factors facilitating student learning.

The research objective was addressed through two studies. The research in Study 1 investigated instructor perspectives of factors influencing the levels of success achieved in student thinking skills, collaborative learning and communication skills. The results of Study 1 showed that higher levels of achievement could be achieved by the use of assessment, with assessment of the AOD contributions being the most common approach. The use of a post-AOD assessment was relatively uncommon

among instructors. AOD outcomes were also significantly affected by the information provided to students prior to the commencement of the discussion.

The research in Study 2 investigated student perspectives using a quasi-experiment with participants from a first year university information technology course. The study was developed based on the inconclusive results of Study 1 regarding the use of a post-AOD assessment, and investigated how different forms of assessment can be used to facilitate students' critical thinking skills. This study also examined student awareness of critical thinking skills and concepts.

The findings of Study 2 showed that students perceived significant improvements in their levels of critical thinking after completing an AOD with assessment, regardless of the type of assessment. However there were no significant differences in either perceptions of critical thinking skills or critical thinking skills as measured by an objective test. This suggests, that the form of assessment used in an AOD is less important than the fact that assessment is included. The findings of Study 2 also showed that students consider critical thinking important, are interested in developing their critical thinking skills, but are unsure of how to improve their thinking in general.

The results of the research described in this thesis have practical implications in the use of AOD in undergraduate education and suggest areas for further research. Firstly the results stress the importance of information given to students at the commencement of the discussion, particularly information about the purpose of the discussion. Secondly they highlight the need for further research regarding the use of

a post-AOD assessment. And finally, the results presented in this thesis provide insight into student perceptions of their own critical thinking and issues related to the learning of critical thinking.

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Publications arising from this research

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Chapter 1
Introduction

1.1 Background

Face-to-face in-class discussion has always been regarded as an effective form of learning in higher education (Clarke, 1988; Rourke & Anderson, 2002; Zhu, 1998). Engaging in dialogue gives students the opportunity to verbalise their thoughts, share opinions, confirm understanding of subject matter and, at the same time, improve communication skills (Beaudin, 1999). The face-to-face in-class discussion setting, however, suffers from several shortcomings: face-to-face classes provide limited opportunity for the less confident student, especially if the more verbally skilled students dominate the discussion; the prospect for in-depth discussion is limited due to the temporal nature of the conversational dialogue; and this mode of learning is only available if students are able to meet on campus.

The introduction of online learning in the 1980s hailed the beginning of a revolution in the way distance education would be delivered (Harasim, 1990b). This pedagogical innovation enabled computer mediated communication through a variety of ways, one of which was a text-based environment allowing individuals to interact with one another without the constraint of time and place (Bonk & King, 1998; Purvis, Aspden, Bannister, & Helm, 2011). This discussion space is termed asynchronous online discussion (AOD) and enabled geographically dispersed learners to communicate directly with their instructor, with one another, and with course content in a way not previously possible (Zhu, 1998).

The features of AOD were soon realised to benefit not only distance education students but also to help overcome the limitations of face-to-face in-class discussion by providing the opportunity for reflective discourse and reviewing of previous discussion via the stored transcripts, while at the same time allowing all students to participate in a flexible time and place independent manner (Foley & Schuck, 1998; Greenlaw & DeLoach, 2003; Hara, Bonk, & Angeli, 2000). Thus both distance education and on-campus students were soon to participate and share learning in AOD, which became a key component of online and blended learning environments (Garrison & Vaughan, 2008).

At the same time, there was much enthusiasm about how AOD could promote student learning. The literature addressing the use of AOD is replete with references to the potential opportunities for such an interactive environment to enhance student learning (Corich, Kinshuk, & Hunt, 2004; Hiltz, 1994; Mason & Kaye, 1990; Purvis et al., 2011; Wise, Perera, Hsiao, Speer, & Marbouti, 2012). Foremost among these potential opportunities has been the development of student cognitive skills, especially those skills of complex thinking often associated with critical thinking (Hara et al., 2000; Rodrigues, 1999; Wu & Hiltz, 2004). The potential for collaborative learning, whereby students construct knowledge through the social process of sharing and negotiating meaning, has also been acknowledged by research (Biesenbach-Lucas, 2004; Hron & Friedrich, 2003; Lambert, 2003). Additionally, the reading and writing involved in the dialogue in this environment has been identified as potentially developing communication skills (Wu & Hiltz, 2004).

1.2 Research problem

Despite the overwhelming enthusiasm for the potential benefits of AOD, their subsequent realisation has been somewhat limited (Bullen, 1998; Darabi, Arrastia, Nelson, Cornille, & Liang, 2011; Hew & Cheung, 2014; Murphy & Loveless, 2005). While evidence of critical thinking has been reported (Gunawardena, Lowe, & Anderson, 1997; Shea & Bidjerano, 2009; Williams, 2002), other studies claim that discussions did not reflect in-depth thinking (Ng & Murphy, 2005; Sringham & Geer, 2000). Similarly, while the social construction of knowledge has been shown to occur (Geer, 2003; Hew & Cheung, 2011; Moore & Marra, 2005), it has also been reported that its achievement is limited (Biesenbach-Lucas, 2004; Curtis & Lawson, 2001; Garrison, Anderson, & Archer, 2010; Lambert, 2003). Likewise it has been suggested that the improvement of communication skills has been marginal (Applebee, 1984; Birch & Volkov, 2007; Kienle & Ritterskamp, 2007).

Furthermore, research has highlighted several shortcomings surrounding the use of AOD. Low participation levels can leave participants wondering if 'anyone is out there' (Peters & Hewitt, 2010; Xie, Yu, & Bradshaw, 2014). Social isolation coupled with disconnectedness and loneliness may result in poor quality discussion with few rewards for those making the effort (Rovai & Wighting, 2005). Also, the demands on time for both students (posting, reading and researching) and instructors (moderating the discussion and assessing contributions), add to already over-burdened workloads (DiBiase, 2004; Gerbic, 2006; Goldman, 2011; Lazarus, 2003). At the same time, it has been argued that online discussion is vastly different from traditional face-to-face in-class discussion and therefore that new teaching paradigms need to be researched,

created and adopted (Beebe, Vonderwell, & Boboc, 2010; Hara et al., 2000; Harasim, 1989; Kao, 2013).

In order to address the limited achievement of the potential benefits associated with AOD and overcome its shortcomings, research has focused on investigating conditions conducive to quality discussion and factors facilitating student learning. Research studies have covered many different aspects of AOD, some of which include: interaction (Ertmer, Sadaf, & Ertmer, 2011; Kanuka, 2011; LaPointe & Gunawarndena, 2004; Moore, 1989; Picciano, 2002; Schrire, 2004; Zhu, 2006); evaluating learning (Bullen, 1998; Hara et al., 2000; Henri, 1992; Newman, Webb, & Cochrane, 1995; Salmon, 2000); moderation used to manage the discussions (Berge, 1995; Mandernach, Forrest, Babutzke, & Manker, 2009; Rourke & Anderson, 2002; Xie & Ke, 2011); instructional strategies (Beaudin, 1999; Biesenbach-Lucas, 2004; Bradley, Thom, Hayes, & Hay, 2008; Darabi et al., 2011; Hara et al., 2000; Hew & Cheung, 2011); the link between the learning process and associated learning outcomes (Akyol & Garrison, 2011; Garrison, Anderson, & Archer, 1999; Garrison et al., 2010; Rovai, 2007); and student experience of AOD (Hamann, Pollock, & Wilson, 2012; So & Brush, 2008; Swan, 2001; Tapper 2004; Yuankun, 2012).

In real educational settings the many uses of AOD may be categorised into either structured or unstructured (Yang, Newby, & Bill, 2008). Generally, structured AOD have a pedagogical purpose with clear guidelines about the expectations of the AOD learning activity. An unstructured AOD has no specific task, is not tied to any assessment, nor is participation compulsory. The research described in this thesis is focused on the former; that is, the structured use of AOD.

However, despite the abundance of the research investigating the myriad of possible factors and conditions that may influence the achievement of student learning outcomes in AOD, there remain inconsistent findings. Research is still needed to identify and clarify what is needed to fully realise the potential benefits that can be achieved in this discussion environment.

1.3 Purpose of the research

Research aimed at finding ways to enhance student learning outcomes in AOD has examined many different factors and conditions. Though there has been some consistency in the findings of research within these areas, at the same time there are still unresolved issues.

The use of assessment is such an area. On the one hand, it is claimed that where AOD is not assessed there appears to be little effort to participate (Hara et al., 2000; Palmer & Holt, 2009; Williams, 2002) while, on the other hand, it is also suggested that assessment tends to stifle dialogue and is a contradiction of the constructivist principles upon which AOD is based (Gulati, 2008; O'Reilly & Newton, 2001). Additionally, it is unclear what should be assessed: the AOD contributions or possibly some sort of a post-AOD reflection paper (Dennen, 2008a; Greenlaw & DeLoach, 2003).

Similarly, there is general agreement that instructor support is essential for successful AOD, but the degree of support and the form of this support is less clear. While instructor moderation is generally advocated (Kanuka, Rourke, & Laflamme, 2007; Rovai, 2007; Shea, Sau Li, & Pickett, 2006), there are differing suggestions for how

this should be implemented (An, Shin, & Lim, 2009; Mandernach et al., 2009; Mazzolini & Maddison, 2007). Additionally, there are calls for student moderation (Hew & Cheung, 2011; Wang, 2008; Xie & Ke, 2011).

In designing and implementing AOD, research has investigated techniques such as message labelling (Schellens, VanKeer, DeWeaver, & Valcke, 2009; Topcu, 2010), role assignment (De Wever, Schellens, Van Keer, & Valcke, 2009; Hara et al., 2000), use of questions (Bradley et al., 2008; Yang, Newby, & Bill, 2005), various types of supporting materials (Alexander, Commander, Greenberg, & Ward, 2010; Duphorne & Gunawardena, 2005; Gilbert & Dabbagh, 2005), and different AOD designs (Kanuka et al., 2007; Richardson & Ice, 2010). Likewise the effect of student characteristics (Chen & Caropreso, 2004; Hiltz & Shea, 2005; Meyer, 2008; Tallent-Runnels et al., 2006), and technology issues (Gao, Zhang, & Franklin, 2013; Kent, 2013; Rodrigues, 1999; Sher, 2009; Vonderwell & Zachariah, 2005) have all been researched reporting varying degrees of success.

Therefore, given the inconsistencies in research findings and unresolved issues regarding learning in an AOD, the aim of the research described in this thesis was to investigate how student learning outcomes may be enhanced in AOD. With this aim in mind, the conditions conducive to quality discussion and factors facilitating student learning were investigated. The research described in this thesis sought to answer the following research question:

How can student learning outcomes be enhanced in an asynchronous online discussion (AOD)?

1.4 Significance of the research

Institutions of higher education have experienced a proliferation of online and blended courses in recent years (Beebe et al., 2010). In 2012 Open Universities Australia, a conglomerate of 20 universities offering online courses, reported increased enrolments of 32% in 2009, 36% in 2010 and 28% in 2011 (Open Universities Australia, 2012). International trends in online learning are similar (Oncu & Cakir, 2011). At the same time, blended learning has become an integral part of the learning landscape as more and more traditional campus-based courses incorporate online components (Stacey & Gerbic, 2009). Within both these learning environments AOD has become an important pedagogical communication component but is especially relevant for online courses, where students and instructors are unable to meet face-to-face (Ertmer et al., 2011; Uzuner, 2007). As such, continued research in the design, implementation and learning implications of AOD is essential to facilitate successful student learning.

The development of student critical thinking skills is an important aim of many tertiary institutions with the ability to reason, think analytically and justify conclusions regarded as essential skills for today's graduates (Angeli & Valanides, 2009; Carrington, Chen, Davies, Kaur, & Neville, 2011; Davies, 2011; Golding, 2011). Australian universities have acknowledged the importance of these skills in preparing students for the workplace by incorporating critical thinking skills into desired outcomes for their graduates (Moore, 2004; Mummery & Morton-Allen, 2009; Prasad, 2009). The environment of AOD provides students with opportunities to engage with one another in ways that can potentially promote critical thinking (MacKnight, 2000; Prasad, 2009).

This increased growth in online and blended learning, incorporating AOD to help develop the complex thinking skills in students, continues to drive research about AOD. Though great research strides has been there is still a continuous refrain in the literature for practical suggestions that may be easily implemented within a course curriculum (Gerbic, 2006; Gilbert & Dabbagh, 2005; Maurino, 2007).

The research described in this thesis is an attempt to address this need and help instructors facilitate and promote quality discussion in the AOD environment. In the process, the research contributes to the ongoing efforts to understand the learning process in an AOD environment and improve learning outcomes.

1.5 Research approach

The aim of the research described in the thesis was to investigate how student learning outcomes may be enhanced in AOD. To address this aim, two research questions were identified and addressed in two separate studies.

Study 1 was an exploratory study undertaken to investigate factors potentially affecting the achievement of AOD outcomes. The perceptions of Australian and international instructors about the use of AOD in their teaching were collected using an online survey. The research described in Study 1 sought to answer the following overarching research question:

RQ1: *What factors enhance discussion outcomes in a structured asynchronous online discussion (AOD)?*

An important finding of Study 1 was that assessment is a significant factor in the enhancement of complex thinking especially that associated with critical thinking. Hence a second research question was identified:

RQ2: How can the use of assessment enhance student critical thinking skills in asynchronous online discussion (AOD)?

Study 2 was conducted to investigate the effect of assessment on the discussion outcome of critical thinking. Study 2 employed a mixed methodology, using an experiment in a real educational setting with first year undergraduates at an Australian university. The experiment investigated two different forms of assessment and was followed by interviews to elaborate on the findings of the experiment. Student perceptions of critical thinking and AOD were also examined.

The outcome of this second study provided further insight into the use of assessment, and its impact on student critical thinking skills in an AOD, as well as student awareness of critical thinking skills and concepts.

1.6 Organisation of the thesis

This thesis is presented in 11 chapters. Chapter 1 provides an overview of AOD, its importance in tertiary education, and the unresolved issues relating to AOD identified in the literature. It also describes the aims and significance of the research and provides an overview of the research approach.

The literature on AOD relevant to the research described in this thesis is presented in Chapter 2. The chapter begins with a brief background to AOD followed by an

introduction to the learning outcomes often associated with AOD and the achievement of these outcomes. The next section reviews the literature relating to a number of factors that have been targeted as potentially improving levels in the achievement of AOD learning outcomes. The issues raised in the literature review highlight the need for further research into this important area in order to fully realize the benefits associated with this discussion environment, and inform the research design of Study 1.

Chapters 3 to 6 discuss the first study undertaken, a survey examining instructors' perceptions of factors potentially influencing AOD outcomes. Chapter 3 identifies the research questions for Study 1, while Chapter 4 provides a detailed description of the research methodology including the study design, instrument development, data collection and data analysis technique used in the study. The results of Study 1 are presented in Chapter 5, beginning with a description of the participants in the study followed by the results of the data analysis necessary to answer the research questions listed in Chapter 3. Chapter 6 discusses the findings of Study 1. The results of this study are discussed in the light of their practical and research implications, and issues requiring further research are highlighted for investigation in Study 2.

Chapters 7 to 10 relate to Study 2. The research questions for the second study are presented in Chapter 7 along with a number of hypotheses based on the findings of Study 1 and relevant literature. A detailed description of the research carried out in Study 2 is provided in Chapter 8. The research methodology is presented including the targeted sample of participants, the study design, ethical issues and instruments used in the study. The study's procedure is detailed as well as validity issues, and the

data analysis process for both the quantitative and qualitative aspects of Study 2. Chapter 9 presents the results of Study 2. A description of the participants is presented and the impact of two different assessment approaches on students' critical thinking skills is examined. The hypotheses of the study are also addressed. In Chapter 10 the findings of Study 2 are discussed and situated within the literature either confirming and/or contrasting with that of previous studies. Finally the limitations of Study 2 are presented.

The concluding Chapter 11 brings together the findings of both Study 1 and 2 to summarise the research and its implications, and the contribution of the research to the current body of knowledge is assessed. A number of recommendations are made both for practice and future research.

A glossary of terms used in this thesis is presented in Appendix A.

Chapter 2
Literature Review

2.1 Introduction

This chapter reviews the literature on AOD. Different aspects of AOD have been emphasised since its introduction. During the 1990s the literature was replete with references to the potential of AOD to facilitate complex thinking skills; however, little was known or understood about whether this potential could be realised (Bullen, 1997). Since then, many studies (Akyol & Garrison, 2011; Darabi et al., 2011; Garrison, Anderson, & Archer, 2001; Garrison & Arbaugh, 2007) have examined the realisation of this potential, along with the factors and conditions that contribute towards enhancing student learning in AOD.

This literature review is divided into four sections. Section 2.2 briefly presents the background of AOD, both in terms of the adoption of online learning, particularly computer conferencing, and the accompanying research of the time. Section 2.3 discusses the learning outcomes potentially associated with AOD, and introduces the various terms to be used in the research described in this thesis. Section 2.4 presents the extent of achievement of AOD learning outcomes that have been reported, while Section 2.5 discusses in detail the factors that appear to facilitate the achievement of learning outcomes.

2.2 Background to AOD

The 1980s marked the arrival of what Nipper (1989) has called the third generation in distance education, with the adoption of computer mediated communication (CMC). This third generation changed the production and distribution of course materials and the limited two-way student-instructor communication model. Learning as a social process became a distinctive element of this third generation with computer conferencing, one component of CMC, enabling interactive communication among students for the first time. It was thought that the connection and interaction necessary for distance education students to feel fully part of the educational experience had finally arrived (Bullen, 1998; Darabi et al., 2011; Garrison, 1997; Kaye, 1989).

As Harasim (1990a) and Hiltz(1990) were quick to point out, however, the benefits afforded by the interactive communication of computer conferencing were seen to enhance learning for all students, not just those geographically dispersed. As a result, computer conferencing became a part of traditional on-campus education, blurring the line between local and distance learning. The new concept of online education described this unique combination of computer mediated attributes with existing traditional teaching attributes (Harasim, 1990a).

During the 1980s, open universities in the US, UK and Denmark as well as educational institutions in Canada had all incorporated CMC components into their distance education offerings, while Guelph University in Ontario, University of Victoria in British Columbia and Rochester Institute of Technology in New York

were offering blended online education for all students (Hiltz & Goldman, 2005; Kaye, 1989).

At the same time, research in computer conferencing primarily centred on evaluative case studies reporting quantitative participation levels. While acknowledging the contribution of this research, Mason (1989) began questioning the relevance of user statistics generated by these studies to the actual content of the discussion messages. Likewise, Harasim (1987) stated that there was very little information "describing or analysing teaching and learning within this asynchronous, text-based environment and its potential impact on teaching and student learning" (p. 119).

These calls for a change in research direction were answered throughout the 1990s with studies by Henri (1992), Garrison (1992), Gunawardena (1997), Newman, Webb and Cochrane (1995), Zhu (1996) and Bullen (1998) among others. This body of research investigated the learning taking place in this new environment by examining the interaction within the discussion and how this could be measured and evaluated. Thus a solid foundation in AOD research was formed upon which subsequent studies could build.

During the early 1990s, technological advancements in computer hardware and software facilitated the adoption of online learning. The arrival of the World Wide Web, coupled with online learning management systems (LMS) such as WebCT™ and Blackboard™, enabled easy access to communication tools in ways not previously possible. LMS provided what was considered at the time to be an easy-to-use platform for instructors to create entire online courses and/or incorporate online

components into traditional on campus courses. These LMS included a discussion forum tool, commonly known as AOD, which became the key component for interactive communication.

Online learning grew exponentially during the first decade of the 21st century with AOD continuing to be an integral part of the online environment (Ertmer et al., 2011; Oncu & Cakir, 2011; Uzuner, 2007). Open-source LMS such as Moodle™ and more recently Facebook™ are being explored as newer platforms for AOD (Deng & Tavares, 2013; Wise & Chiu, 2011).

Research continues to examine the enhancement of learning using AOD and most recently has focused on investigating conditions conducive to quality discussion and factors facilitating student learning. Research reporting on the achievement of learning outcomes in AOD is discussed fully in Section 2.4, but firstly the potential learning outcomes associated with AOD need to be defined.

2.3 Defining AOD learning outcomes

A learning outcome is a statement that describes what a learner is expected to know, understand or be able to do as a result of learning (Anderson & Krathwohl, 2001; Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956). Courses of study commonly state explicit learning outcomes so that students are aware of what knowledge and/or skills they are expected to achieve by completing the course.

AOD outcomes have been defined in various ways depending on the theoretical orientation and investigative locus of the research. However, two major discussion

learning outcomes may be identified in the literature: high order thinking (Angeli, Valanides, & Bonk, 2003; Hammond, 2000; Hiltz, 1997; Pena-Shaff & Nicholls, 2004); and the social construction of knowledge (Gunawardena et al., 1997; Kaye, 1991). These two discussion outcomes will now be discussed and defined.

Bloom's Taxonomy of Educational Objectives for the Cognitive Domain (1956) has a long-standing pedigree of established pedagogical use for defining thinking skills (Meyer, 2004). Anderson and Krathwohl (2001) note, that in adopting Bloom's Taxonomy, it is common practice to subdivide the six levels into two broad areas: low level thinking operations consisting of remembering, understanding and applying; and high level thinking operations consisting of analysing, synthesizing and evaluating. This practice is widely employed by researchers (Bradley et al., 2008; Ertmer et al., 2011; Gilbert & Dabbagh, 2005; Gokhale, 1995; Krathwohl, 2002; McLoughlin & Luca, 2000; Schrire, 2006), and is similarly used for the research described in this thesis. Low level thinking operations will be referred to as low order thinking, while high level thinking operations will be referred to as high order thinking. The words 'thinking' and 'cognition' are considered substitutionally equivalent here.

Numerous labels have been used for learning outcomes associated with high order thinking: critical thinking (Angeli et al., 2003; Duphorne & Gunawardena, 2005; Fahy, 2005; Newman et al., 1995; Richardson & Ice, 2010; Stupnisky, Renaud, Daniels, Haynes, & Perry, 2008; Szabo & Schwartz, 2011; Thomas, 2002); higher-order thinking (Bradley et al., 2008; McLoughlin & Mynard, 2009; Meyer, 2003; Schrire, 2002); cognitive engagement (Thomas, 2002; Zhu, 2006); thinking levels

(Meyer, 2004, 2005); cognitive presence (Akyol & Garrison, 2011; Darabi et al., 2011; Garrison et al., 2001); deep learning (Aviv, 2000); and critical discourse (Kanuka et al., 2007). However, upon examining the meanings behind the numerous labels used to describe thinking associated learning outcomes, it may be reasonable to conclude that high order thinking is the overall goal that educationalists are seeking in the achievement of these variously labelled thinking terms (for a comparative analysis of these terms see Appendix B). Critical thinking is one of the most commonly cited outcomes, not only in the literature related to AOD, but in the literature of many disciplines. Therefore critical thinking is defined as being the same as high order thinking (Gokhale, 1995), and both terms are used interchangeably for the research described in this thesis.

In contrast, the second learning outcome, the social construction of knowledge, does not appear to suffer from the same multiple labelling issues as that of high order thinking. Whereas high order thinking focuses on individual learning, the social construction of knowledge focuses on the interaction happening in an AOD as a whole. The proposed ability of AOD to enable students to construct meaning and integrate new knowledge into their prior experience via social interaction is derived from three ideas: firstly, that knowledge can be socially generated (Vygotsky, 1978); secondly, that the computer can create an interactive environment for the implementation of constructivist strategies (Harasim, 1989; Hiltz & Wellman, 1997); and thirdly, that social learning emphasises interaction involving sharing and exchanging information with others in a group problem solving environment (Alavi, Wheeler, & Valacich, 1995; Darabi et al., 2011; Leidner & Jarvenpaa, 1995).

Gunawardena and colleagues (1997) specifically designed a theoretical framework, the Interactional Analysis Model, to examine "the negotiation of meaning and co-construction of knowledge in collaborative learning environments facilitated by computer conferencing" (p. 397). Interaction was defined as "the totality of interconnected and mutually-responsive messages" (Gunawardena et al., 1997, p. 407), and is essentially the process of putting together the pieces of knowledge (facts, opinions, or ideas) in the co-creation of new knowledge. The widespread use of the Interactional Analysis Model (De Wever et al., 2009; De Wever, Van Keer, Schellens, & Valcke, 2007; Geer, 2003; Hew & Cheung, 2011; McLoughlin & Luca, 2000; Moore & Marra, 2005; Saritas, 2008; Schellens & Valcke, 2005; Wise & Chiu, 2011) together with several descriptions of the social construction of knowledge (Pena-Shaff & Nicholls, 2004; Veerman & Veldhuis-Diermanse, 2001; Weinberger & Fischer, 2006), support the notion that any definition of this outcome should contain the following aspects: interaction is the essential element; participants share information, experience and values; consensus is negotiated via argument; and finally, new knowledge is created. Therefore the definition of the social construction of knowledge used for the research described in this thesis incorporates these aspects and is defined as the interactive sharing of information, experience and values in an AOD that encourages argument about meaning, and culminates in the negotiated creation of new knowledge.

Although high order thinking and knowledge construction are usually presented as two distinct outcomes, several researchers have highlighted an overlap between these concepts. Gunawardena et al. (1997) point out that an AOD message represents both a student's cognitive activity and their contribution to the construction of knowledge.

Similarly, Buraphadeja and Dawson (2008) describe the function of the Interaction Analysis Model (Gunawardena et al., 1997) as being to categorise transcripts into phases of knowledge construction by examining the critical thinking skills exhibited in the AOD messages, and Schrire (2006) defines the development of critical thinking in computer conferencing as "a collaborative knowledge-building process" (p. 55).

A third less frequently acknowledged AOD outcome is that of improved communication skills in the form of reading and writing, which can be identified as a by-product of engaging in text-based dialogue (Applebee, 1984; Biesenbach-Lucas, 2004; Feenberg, 1989). It has been suggested that the act of reading and constructing responses encourages discipline and rigour not only in thinking but in communicating, so that student communication skills should continue to develop and improve as a result of participating in online discussion (Applebee, 1984; Kienle & Ritterskamp, 2007; MacKinnon, 2000). Pena-Shaff (2004) asserts that "because most online communication is text-based, it has the potential to strengthen writing skills and encourage more deliberate articulation of ideas" (p. 244).

While there has been general agreement about these learning outcomes potentially arising from AOD, it has proved more difficult to demonstrate these in practice. This is discussed next in Section 2.4.

2.4 The achievement of AOD learning outcomes

2.4.1 Thinking skills in AOD

The assessment of cognitive skills in AOD has generally been evaluated by transcript analysis of the discussion, perception studies using surveys and interviews, assessment grades and commercial tests. Content analysis has been the most frequently used method, drawing on a number of frameworks: general educational frameworks such as Bloom's Taxonomy (Bloom et al., 1956) and the Structure of the Observed Learning Outcome (SOLO) taxonomy (Biggs, 1979); and frameworks especially developed for AOD such as those by Henri (1992), Garrison (1992), Newman, Webb and Cochrane (1995), Zhu (1996), Bullen (1998) and the Practical Inquiry Model (PIM) (Garrison et al., 1999, 2001). Due to the variety of methods employed and the concepts upon which they are based, it is very difficult to compare results directly about the degree of high order thinking achieved in the AOD environment. However, it is possible to identify a general conclusion that high order thinking does not happen to any great extent in an AOD, as is discussed below.

During the 1990s, research focused on evaluating the online learning experience, with particular attention to AOD. Newman et al. (1995), using concepts developed by Henri (1992) and Garrison (1991), developed a framework for assessing critical thinking in computer conferencing. Their study compared the critical thinking displayed in computer conferencing and face-to-face seminars by second year undergraduates. Content analysis showed that in the computer conference not only did the majority of statements reflect critical thinking, but these statements also showed deeper levels within critical thinking compared to those displayed in the face-to-face seminars. This framework developed by Newman et al, however, has

been questioned by subsequent researchers regarding its reliability (De Wever, Schellens, Van Keer, & Valcke, 2006; Guiller, Durndell, & Ross, 2008), issues with interpretation (Marra, Moore, & Klimczak, 2004) and insufficient category descriptors (Pena-Shaff & Nicholls, 2004).

Bullen (1998) investigated the critical thinking of third year students using content analysis of the AOD and interviews. He reported that although students in his study had used some critical thinking skills, they had not done so at any consistently high level. Bullen concluded the contradictory results between his study and those of Newman et al. (1995) may have been due to their different conceptualisations of critical thinking. He also confirmed earlier suggestions about the impact of instructor facilitation, course design, and student characteristics on critical thinking outcomes. Finally, Bullen raised the issue of whether students' understanding of critical thinking has an impact on their use of critical thinking skills, and suggested that students in their early to mid-20s may lack the higher levels of cognitive maturity required for the reflective thinking process involved in critical analysis.

Thomas (2002) evaluated levels of cognitive engagement as operationalised in the SOLO educational taxonomy (Biggs, 1979) and critical thinking as operationalised in Bullen's (1998) framework. He reported the display of high levels of cognitive engagement and critical thinking in the postings of the AOD. Thomas classified levels three and four of the SOLO taxonomy as representing "relatively high levels of cognitive engagement" (Thomas, 2002p. 357), while Boulton-Lewis (1998) and Schrire (2004) assert that levels four and five of this taxonomy represent high order

thinking. This inconsistency highlights the issue raised by Rourke (2001) about the inherently subjective interpretation involved in content analysis.

Studies by McKenzie (2000) investigating critical thinking, Sringham (2000) investigating higher cognitive skills, and Ng and Murphy (2005) investigating higher-order reasoning, all based their conceptions of thinking on those developed by Henri (1992) and all reported little evidence of complex cognition skills. Hara et al. (2000), also basing their work on Henri's framework, examined the effect of using a 'starter/wrapper' technique on cognitive levels and depth of processing in the online discussion of 20 graduate psychology students. These authors reported that "students were using high level cognitive skills such as inferencing and judgment as well as metacognitive strategies related to reflecting on experience and self-awareness" (p. 115). This interpretation of inferencing representing a high level cognitive skill is contrary to that of Corich (2004) who also used Henri's framework, but interpreted the 'inference' skill as representing middle levels of cognitive skills. So, while Hara et al. (2000) reported high levels in cognitive skills, Corich et al. (2004) reported middle levels only. These differing interpretations again highlight the difficulty of comparing results from different studies using content analysis, even when almost identical frameworks are used.

Another framework that is often used in AOD research for evaluating different levels of thinking is the Practical Inquiry Model (PIM) (Garrison et al., 1999, 2001) where critical thinking is defined as both a process consisting of exhibited behaviours, and as a product contributing to a deep understanding of some content. While Rourke and Kanuka (2009) have questioned the use of the PIM to measure thinking outcomes in

AOD, other researchers (Fahy, 2005; Meyer, 2004; Schrire, 2002, 2004) have compared the results of using the PIM with other evaluative frameworks to assess thinking skills in AOD. They have all reported that the PIM produces consistent results with frameworks specifically created to measure high order thinking in AOD. Schrire (2006) concluded the PIM "to be the most relevant [framework] to the analysis of the cognitive dimension" (p. 491) in AOD.

In studies using the PIM to assess the cognitive skills displayed in AOD, it has been generally reported that skills largely fall into the middle levels of this framework consisting of exploration (generally considered low order thinking) and integration (representing the beginnings of high order thinking) with some weighting towards exploration (Darabi et al., 2011; Fahy, 2005; Garrison & Arbaugh, 2007; Kanuka et al., 2007; Luebeck & Bice, 2005; McLoughlin & Mynard, 2009; Meyer, 2003; Murphy, 2004a; Pisutova-Gerbe & Malovicova, 2009). Other studies though have reported a tendency towards integration in the levels of high order thinking (Akyol & Garrison, 2011; De Leng, Dolmans, Jobsis, Muijtjens, & van der Vleuten, 2009; Marra et al., 2004; Meyer, 2004; Richardson & Ice, 2010).

Studies that have created their own framework have also reported a lack of high order thinking exhibited in AOD (Angeli et al., 2003; Aviv, 2000; DeLoach & Greenlaw, 2005; Fahy, 2002, 2005; Greenlaw & DeLoach, 2003; Hew & Cheung, 2003; Hew & Cheung, 2012; McKenzie & Murphy, 2000; So & Brush, 2008). Similar results have also been reported by studies that have used Bloom's (1956) original taxonomy (Bradley et al., 2008; Christopher, Thomas, & Tallent-Runnels, 2004; Gilbert & Dabbagh, 2005; Kay, 2006; Meyer, 2005; Szabo & Schwartz, 2011)

or the revised version (Anderson & Krathwohl, 2001). Maurino (2007) reviewed 37 studies to assess the state of critical thinking in online discussions and concluded that critical thinking was not happening to any great extent. Garrison and Arbaugh (2007) have acknowledged similar concerns stating that "the issue revealed consistently in the research findings is that inquiry invariably has great difficulty moving beyond the information exchange or exploration phase" (p. 162) to that of integration and resolution, levels more representative of high order thinking.

In response to these poor levels in student thinking outcomes using AOD, researchers have investigated factors that may improve these thinking outcomes, including the use of assessment (Dennen, 2008a; Gulati, 2008; Hew, Cheung, & Ng, 2010; Palmer & Holt, 2009), message labelling (Schellens et al., 2009; Topcu, 2010), instructional strategies (Darabi et al., 2011; Kanuka et al., 2007; Richardson & Ice, 2010) use of questions (Akin & Neal, 2007; Cheong & Cheung, 2008; Yang et al., 2005), and moderation (Garrison & Arbaugh, 2007; Mazzolini & Maddison, 2007; Rovai, 2007). This research is discussed in Section 2.5.

2.4.2 The social construction of knowledge in AOD

Unlike the variety of frameworks used for evaluating thinking outcomes, the most commonly used framework for investigating knowledge construction in AOD has been the Interaction Analysis Model (IAM) (Gunawardena et al., 1997). The IAM incorporates several important features associated with collaborative learning environments (De Wever et al., 2006) and, together with its reliability (Marra et al., 2004) and consistency with constructivist knowledge literature (Kanuka & Anderson,

1998), it has become one of the most appropriate methods to assess knowledge construction in AOD environments (Hew & Cheung, 2008).

AOD research has suggested that the levels of rich interaction necessary for quality knowledge construction are yet to be achieved in the AOD environment. Typically the discussion space has been a place for listing and sharing ideas, with higher levels of knowledge seldom found (Hew & Cheung, 2011; Liu, Doore, & Li, 2008; McLoughlin & Luca, 2000; Wise & Chiu, 2011; Xie & Ke, 2011). Studies that have applied the IAM have found that the majority of knowledge construction displayed in an AOD is indicative of the model's Phase I, which describes the lower mental functions of sharing and comparing information (Hendricks & Maor, 2004; McLoughlin & Luca, 2000; Saritas, 2008; Schellens & Valcke, 2005; Sringham & Geer, 2000).

Some studies have reported more encouraging results with occurrences in Phase II (discovery and exploration of dissonance among ideas, concepts or statements) and Phase III (negotiation of meaning) (Geer, 2003; Marra et al., 2004; Moore & Marra, 2005), but overall concern has been expressed at the continuing lack of knowledge construction occurring at the higher levels of Phase IV (testing and modification of proposed synthesis) and Phase V (agreement and application of newly constructed meaning (Hew & Cheung, 2010; Wise & Chiu, 2011).

Researchers using alternative frameworks and methodologies have reported similar results (Kian-Sam & Lee, 2008; Maor, 2010; Pena-Shaff & Nicholls, 2004; Schellens & Valcke, 2006; Veerman & Veldhuis-Diermanse, 2001; Xie & Ke, 2011; Zhu,

1996). For example, Pena-Shaff (2004) and Zhu (1996), focusing on identifying different types of interaction, both reported that interaction was mostly clarification and interpretation with some conflict, assertion and reflection.

In order to improve the student levels of knowledge construction using AOD, it has been suggested that collaborative learning activities that emphasise cooperative efforts need to be actively implemented (Hron & Friedrich, 2003). In the environment of AOD, collaborative learning refers to small groups working together on shared tasks that involve controversy thus bringing together information, ideas, solutions, and opinions that are not always compatible with one another (Schellens & Valcke, 2006). Hiltz and Turoff (2002) stress the importance of involving students in creating AOD topics, leading these discussions and providing regular summaries of what is discussed, while debates, case studies, simulation and role-playing exercises should be encouraged activities within AOD.

Several of these suggestions, such as debate and case study (Darabi et al., 2011), role play (Wise & Chiu, 2011) and student facilitation (Hew & Cheung, 2011), have been subsequently incorporated into research studies. A full discussion of these research results is presented in Section 2.5.

2.4.3 Communication skills in AOD

The improvement of student communication skills has been suggested as a desirable outcome of AOD. The literature suggests that the act of reading and writing encourages discipline and rigour not only in thinking but in communicating, resulting in the improvement of student communication skills (Applebee, 1984; Kienle &

Ritterskamp, 2007; MacKinnon, 2000). Since communication in an AOD is primarily text-based, involving reading contributions and creating written responses, participation in AOD should strengthen student writing skills (Dallimore, Hertenstein, & Platt, 2008; Kian-Sam & Lee, 2008; Pena-Shaff & Nicholls, 2004). Additionally, more care may be taken in articulating contributions as the lack of gestures and emotions may require more explicit communication of ideas (Du, Zhang, Olinzock, & Adams, 2008; Vonderwell, Liang, & Alderman, 2007).

However, despite these suggestions and employer emphasis on the importance and relevance of these skills in the workplace (Barrie, 2004; Bridgstock, 2009; Williams & Mason, 2009), this connection between AOD activities and possible improvements in communication skills has not been extensively examined. Hiltz (1990) investigated whether participation in online learning environments would improve student writing skills compared to students in a face-to-face situation. She reported no significant difference between the groups but commented on the difficulty of measuring improvements in writing skills. Several studies (Birch & Volkov, 2007; Cathey, 2007; Ellis, Calvo, Levy, & Tan, 2004; Vonderwell, 2003) have questioned students about their communication skills and all reported that the participants believed the AOD contributed to the development of their communication skills. Ellis et al. (2004) surveyed third year undergraduate students who indicated that the AOD not only helped to develop their communication skills, but that the perceived improvements in these skills was a factor motivating them to participate in the AOD.

This section of the literature review has discussed learning outcomes associated with AOD. The attainment of high order thinking skills, especially those associated with

critical thinking, the facilitation of the social construction of knowledge, and the development of student communication skills, are far from straightforward. While some success in achieving these outcomes has been reported, studies continue to investigate factors that have the potential to enhance these learning outcomes. The results of these studies are addressed in the following section.

2.5 Factors influencing AOD learning outcomes

In order to address the limited achievement of AOD outcomes, research has focused on investigating factors and conditions conducive to quality discussion. When investigating such factors and conditions, studies have tended to base their research on the following categories: instructor related factors (An et al., 2009; Arbaugh & Benbunan-Fich, 2005; Benbunan-Fich, Hiltz, & Harasim, 2005; Gerber, Scott, Clements, & Sarama, 2005; Gerbic, 2006; Goldman, 2011; Mazzolini & Maddison, 2003, 2007; Mortera-Gutierrez, 2002); course related factors (Al-Fadhli & Khalfan, 2009; Beaudin, 1999; Christopher et al., 2004; DeLoach & Greenlaw, 2005; Ellis et al., 2004; Gilbert & Dabbagh, 2005; Hew et al., 2010; Swan, 2001; Tallent-Runnels et al., 2006; Tolmie & Boyle, 2000); student related factors (Arbaugh, 2000; Beaudoin, 2002; Brescia & Miller, 2005; Christopher et al., 2004; Deng & Tavares, 2013; Dutton, Dutton, & Perry, 2002; Hiltz & Shea, 2005; Richardson & Swan, 2003; Xie, 2013); and technology related factors (Gerbic, 2006; Hammond, 2000; Murphy & Coleman, 2004; Rodrigues, 1999; Vonderwell & Zachariah, 2005; Wu & Hiltz, 2004). Table 2-1 shows the factors that will be discussed in the following sections of this literature review.

Table 2-1: Factors proposed to influence AOD learning outcomes

Stating the purpose for an AOD learning activity (Section 2.5.1)
Protocols used in AOD (Section 2.5.2)
Pedagogical strategies used in AOD :
Different types of AOD Design (Section 2.5.3.1)
Supporting materials (Section 2.5.3.2)
Group size (Section 2.5.3.3)
Questions (Section 2.5.3.4)
Message labelling (Section 2.5.3.5)
Participant role assignment (Section 2.5.3.6)
Assessment used in AOD (Section 2.5.4)
Moderation used in AOD (Section 2.5.5)
Student characteristics (Section 2.5.6)
Technology issues (Section 2.5.7)

As described in Section 1.2, AOD may be either unstructured or structured (Yang et al., 2008). An unstructured AOD has no specific task, is not tied to any assessment, nor is participation compulsory. It may include the exchange of information between instructor and students, as well as between students. Unstructured AOD help promote community building and social presence and are considered essential in online environments where students do not have the opportunity to become acquainted with one another face-to-face (Garrison et al., 1999). Unstructured uses of AOD may include as a type of helpdesk for administrative matters (Curtin, 2002), as a place for

students to freely exchange information (Rovai, 2007), or for provision of advice and feedback on course assessments (Yang et al., 2008).

A structured AOD, on the other hand, has a pedagogical purpose with clear guidelines about the expectations of the AOD learning activity. Assigned topic discussion or open-ended topical discussion are the most common uses for a structured AOD (Richardson & Ice, 2010). This type of discussion involves the exploration of a topic, concept or experience, and may consist of some or all of three major elements: a discussion theme; a series of questions; and a set of readings (Greenlaw & DeLoach, 2003; Picciano, 2002; Richardson & Ice, 2010; Rovai, 2007; Thomas, 2002). Table 2-2 shows an example of a typical assigned topic discussion with the three elements. The discussion theme, consisting of one or more sentences

Table 2-2: Assigned topic discussion example with elements of theme, questions and readings (Greenlaw & DeLoach, 2003, p 43)

Discussion theme	What caused the decrease in productivity growth in the US economy beginning about 1973?
Questions	Exactly what do we mean by productivity growth? How do we measure it? What is the evidence that productivity growth has declined?
Readings	Hall and Taylor 1993, pp. 84-93. Washington Post Archives: http://www.washingtonpost.com/wp-srv/politics/herblock/archives.htm Federal Reserve puplications: http://www.federalreserve.gov/publications/default.htm 'The productivity growth slowdown: diverging trends in manufacturing', Kozicki, Sharon 1997 'Downsizing and productivity growth: myth or reality?', Bartelsman, Eric J. 1994 'Public investment and productivity growth in the Group of Seven', Aschauer, David. 1989.

describing an issue, controversy or concept, should provoke thought and dialogue among the discussion participants (Greenlaw & DeLoach, 2003; Sringham & Geer, 2000). A series of open-ended questions should be formulated to generate thought and critical assessment of the discussion topic (Muilenburg & Berge, 2000). Finally, the carefully selected readings need to be within the intellectual capacity of students. The research in this thesis is focused on structured AOD using assigned topic discussion.

2.5.1 Stating the purpose of an AOD learning activity

There appears to be almost universal agreement that if students are aware of why they are completing a learning activity then the associated learning outcome has more chance of successful achievement. This view is reflected in AOD research which suggests that a clear statement of a meaningful discussion purpose results in better achievement of discussion outcomes (Cheung & Hew, 2004-2005; Dennen, 2005; Ellis & Calvo, 2004; Finegold & Cooke, 2006; Hammond, 2000; Pena-Shaff & Nicholls, 2004; Roehm & Bonnel, 2009; Song, Singleton, Hill, & Koh, 2004; Zhu, 2006).

Ellis and Calvo (2004) reported that students who had an understanding of the discussion's relationship to learning outcomes tended to recognise the contribution of the discussion to their learning, compared to students who lacked this understanding. Similarly, a study by Dennen (2005) of nine online courses taught by eight different instructors at seven universities, reported that discussion floundered in those forums where the instructors had not specified their expectations, compared to forums in which instructors had informed students of discussion expectation. Similarly,

"having a clear understanding of what was required to succeed" (Palmer & Holt, 2009, p. 109) was found to be one of three factors to positively influence student satisfaction. After reviewing over 50 empirical studies on AOD research, Hew et al. (2010) concluded that not knowing the purpose of an AOD was one of the major reasons for limited student contributions.

In addition to an AOD having a clear statement of purpose, additional support addressing participation requirements may further contribute to achieving the associated learning outcomes. This type of support is discussed in the following section.

2.5.2 Protocols used in AOD

Protocols used in an AOD may be considered to be those rules and deadlines, issued at the beginning of an AOD, that state the requirements for the discussion (Gilbert & Dabbagh, 2005). Studies have investigated the influence on discussion outcomes of various protocols, such as the time set for discussion (Hara et al., 2000; Hew & Cheung, 2011), setting a minimum number of required postings (Biesenbach-Lucas, 2004; Hara et al., 2000; Murphy & Coleman, 2004), and setting of deadlines (Dennen, 2005; Russell, 2013) .

Hara (2000) suggested that the optimal time for discussion should be long enough to allow time for reflection but short enough to prevent a waning interest in continued participation. Common times set for the duration of online discussions are seven days (Darabi et al., 2011; Gilbert & Dabbagh, 2005), and 14 days (Greenlaw & DeLoach, 2003; Lazarus, 2003; Richardson & Ice, 2010). Hew and Cheung (2011) reported no

correlation between AOD duration and levels of knowledge construction; however, they concluded that due to the lack of research in this area, their results provide a useful starting point for further research.

Biesnebach-Lucas (2004) examined the implementation of a minimum number of required postings and suggested that three postings promoted learning most successfully. On the other hand, Hara (2000) and Murphy (2004) have reported that stating a minimum posting number results in the tendency to post for the sake of having met requirements with little attention to committed and engaging participation.

Gilbert and Dabbaugh (2005) found that restricting postings to between one and two paragraphs not only had a negative impact on the quality of thinking displayed in student postings, but may have actually been partly responsible for decreases in the levels of high order thinking. Jones, Ravid, and Rafaeli (2004) concluded that a balance should be sought between the need for adequate interaction and reflection, and that of information overload and the time required for reading lengthy contributions.

2.5.3 Pedagogical strategies used in AOD

Pedagogical strategies may be described as deliberate and planned goal-oriented learning activities in which the roles of instructors and students are clearly described together with the learning outcomes (Kanuka et al., 2007). In AOD, pedagogical strategies that facilitate interaction are required as communication between students and instructors is the essence of this environment (Tallent-Runnels et al., 2006). It

has been suggested that debate, case study, questions and role-play may all contribute to enhanced online learning (Tenenbaum, Naidu, Jegede, & Austin, 2001). These types of strategies, among others, are addressed in this section.

2.5.3.1 Different types of AOD design

AOD can take place within differently designed environments such as article discussions, jigsaws, scenarios, critical incidents, case studies, controversial topics, and debate (Darabi et al., 2011; Duphorne & Gunawardena, 2005; Kalelioglu & Gulbahar, 2014; Kanuka et al., 2007; Richardson & Ice, 2010). It has been suggested that designs incorporating argumentation support enhance high order thinking by providing a scaffold upon which students can explore different viewpoints and construct their arguments (Bonk & Dennen, 2007; Hron & Friedrich, 2003).

Research on the impact of differently designed AOD has produced mixed results, and the diverse range of designs and varied implementations make comparisons between studies difficult. That said however, the debate design, which consists of a universally accepted set of rules and procedures, has shown some positive results. Richardson and Ice (2010) investigated case-based discussion, debate and open-ended discussion, with debate (77%) just behind case-based discussion (78%) in the percentage of high order thinking messages. Similarly, debate showed encouraging results when compared with the designs of nominal group technique, invited expert, WebQuest (the use of online resources) and reflective deliberation (Kanuka et al., 2007), and with structured, scaffolded and role-play designs (Darabi et al., 2011). It has been suggested that the success of the debate design in AOD is due to its familiar structure using clearly defined roles together with responsibilities compelling

participants to explicitly confront one another's opinions (Kanuka et al., 2007). Case-based design (Richardson & Ice, 2010), WebQuest (Kanuka et al., 2007) and scaffolded design (Darabi et al., 2011) have also been found to stimulate discussion towards high order thinking.

Duphorne and Gunawardena (2005) investigated the use of a problem-posing critical inquiry approach, a problem-solving approach, and a brainstorming approach to assess the impact of these designs on the critical thinking of undergraduate nursing students. Contrary to the above results that showed a debate design had a positive effect on high order thinking, they reported no significant differences between any of the groups. However, Duphorne and Gunawardena used the California Critical Thinking Skills Test in a pre-test/post-test situation to determine differences in high order thinking, whereas the other studies all used content analysis of the discussion postings using the PIM (Garrison et al., 1999, 2001) to report the amounts of high order thinking displayed in the AOD.

2.5.3.2 Supporting materials

Supporting materials are given to students prior to the commencement of an AOD and may be defined as information designed to guide and assist students to create thoughtful engaging contributions. These materials are more about providing advice and guidance for creating successful postings during the AOD (Beaudin, 1999; Dennen, 2005; Murphy & Coleman, 2004), rather than the rules and deadlines of AOD protocols as was described in Section 2.5.2. Supporting materials include discussion or thinking guidelines (Alexander et al., 2010; Bai, 2009; De Leng et al.,

2009; Gilbert & Dabbagh, 2005), evaluation rubrics (Gilbert & Dabbagh, 2005; Rovai, 2007), or various combinations of these (Duphorne & Gunawardena, 2005).

Studies examining the impact of supporting materials have produced positive results. Gilbert and Dabbagh (2005) reported that the use of student facilitation guidelines and an evaluation rubric resulted in increased levels of interaction and thinking. However, when the rubric was introduced into this AOD, the grade weighting was also increased, casting some doubt about the effect of the evaluation rubric alone.

Bai (2009) introducing the PIM (Garrison et al., 1999, 2001) to students explained how it could be applied to their postings. He concluded that this exposure raised student awareness of critical thinking, which in turn promoted reflection and raised levels of thinking displayed in the AOD. Alexander, Commander, Greenberg, and Ward (2010) designed four questions, structured to encourage analysis, reflection, connecting information, and to stimulate inquiry, to be answered prior to engaging in an AOD. Results indicated significantly more evidence of critical thinking in the discussion forums that used the questions compared to those forums that had not.

However, these positive results are not consistent with those reported by Duphorne and Gunawardena (2005). They examined the impact of ‘advance organisers’ (materials describing the critical thinking framework, topic discussion, participation and discussion aims) on the critical thinking skills of nursing students. They reported no significant difference in the critical thinking skills between those students having the advanced organisers and those that did not. However this study also introduced role-play in the AOD, which may have affected the results.

The above research has shown preliminary support for the use of supporting materials to improve outcome levels in AOD. However, providing material alone does not ensure that students will read it, understand it or that they will apply what is suggested in the material. MacKnight (2000) recommended that instructors conduct 'off-line activities' to provide students with a better understanding of the collaborative learning and communication process before commencing the discussion. Similarly, Greenlaw and DeLoach (2003) argue that students need prior instruction on argumentation, suggesting the use of some type of preparatory session before engaging in an AOD. The research investigating supporting materials did not indicate if any interactive activities were employed when introducing the materials. Research is needed to ascertain if any such interventions are being used and to evaluate their impact on discussion outcomes.

2.5.3.3 Group size

Group size is generally defined as the number of students in the discussion forum. In determining optimal group size, a balance between needs to be sought between students feeling overwhelmed with information and little opportunity for in-depth dialogue, and too few members generating insufficient material for effective interaction (Rovai, 2007; Tolmie & Boyle, 2000).

The effect of group size on the occurrences of different levels of social knowledge construction has been examined. Both Schellens and Valcke (2006) and Hew and Cheung (2011) indicated that forums consisting of between eight and ten students resulted in more communication reflecting high levels of knowledge construction than in either smaller groups (Hew & Cheung, 2010, 2011) or larger groups

(Schellens & Valcke, 2006). Additionally, the results of Schellens and Valcke (2006) indicated that the discussion was more intensive and task-focused in groups of eight to ten than was found in larger groups.

Student preferences for group size, however, appear to be much smaller. Twenty postgraduates interviewed by Du et al. (2008) expressed a preference for AOD forums consisting of only three to four students. These students felt that in smaller groups they could be easily acquainted with one another thus creating a socially supportive environment with more opportunities for expressing ideas and less chance of information overload. These students were enrolled in an online course, without the benefits of face-to-face interaction, and it is possible that small groups are more effective in these situations than in blended courses. The impact of this study's preferred group size on the achievement levels of discussion outcomes is unknown as the focus of this study was student perspectives.

2.5.3.4 Questions

The importance in the use of questions in an AOD was highlighted in a survey of 135 online instructors who rated the use of carefully designed questions as the number one factor for keeping AOD on topic (Beaudin, 1999). It has been suggested that critical thinking skills are promoted by good questions that stimulate thinking and create cognitive dissonance thus fostering active engagement in AOD (Akin & Neal, 2007; Cheong & Cheung, 2008; Cook, 2002; Zhu, 2006). However, despite the importance attributed to the use of questions in AOD, little research has been published about the impact of questions on enhancing student thinking outcomes (Bradley et al., 2008). Bradley et al. (2008) focused on the impact of six different

question types on levels of thinking in 114 second year undergraduates. It was reported that though the question types of course link, brainstorm and direct link were most influential in generating high order thinking, overall however, students mainly engaged in low order thinking across all question types.

Similarly, Yang et al. (2005) were interested in facilitating student critical thinking by using Socratic questions. They introduced Socratic questioning techniques to one group during the first half of the semester and to a second group during the second half of the semester. Though results showed there was no significant difference in critical thinking between the two groups, content analysis showed that the group with initial Socratic questioning support continued to display more critical thinking skills after the withdrawal of the questioning technique than did the other group. It was hence concluded that exposure to Socratic questions had an enduring effect on students, and could be withdrawn after students were familiar with the technique.

2.5.3.5 Message labelling

Message labelling in AOD may be defined as a student reviewing their own posted message and applying a label to that message from a predetermined category of cognition levels (Flowers & Cotton, 2007; Murphy & Loveless, 2005). The rationale behind this strategy is that reviewing one's messages raises awareness of performance by providing insights into one's own thinking and possibly resulting in adjustments in the way one learns (Schellens et al., 2009; Topcu, 2010).

Research exploring message labelling in undergraduate courses has been encouraging, suggesting this strategy as a worthy inclusion in AOD (Schellens et al.,

2009; Topcu, 2010; Valcke, 2009). Schellens et al. (2009) concluded that the requirement of message labelling appeared to stimulate more in-depth and focused contributions together with more frequent input of new problem-related information and new ideas for discussion. Similarly, Valcke (2009) reported higher levels of cognitive processing and higher degrees of metacognitive regulation in relation to planning, achieving clarity and monitoring in the online discussion as a result of message labelling. Similar results were reported by Topcu (2010) who suggested that labelling messages "should be a rule of asynchronous online discussion forum protocol" (p. 395).

Though the message labelling strategy appears particularly useful for undergraduate students, research using postgraduate students has produced contradictory results (Flowers & Cotton, 2007; Moore & Marra, 2005). Moore and Marra (2005) reported that the forum in which students were required to label their postings showed lower occurrences of knowledge construction compared to the forum not required to label messages. Although Flowers and Cotton (2007) hypothesized that exposure to message labelling would result in a higher percentage of cognitive units and more complex cognitive processing in masters level student discussions, neither outcome was achieved, and the authors concluded that labelling appeared to have inhibited dialogue. Further research is required to determine if message labelling as an AOD teaching strategy is better suited to undergraduate students.

2.5.3.6 Participant role assignment

Participant role assignment involves students performing specific content-oriented roles during an AOD (Strijbos & De Laat, 2010). The pedagogical use of roles is

well established and it is claimed that its use shifts the focus away from the teacher and helps students accept responsibility for their own learning (Vonderwell & Zachariah, 2005). It has been hypothesised that the assuming of roles would lead to more active engagement in the discussion and thus improve learning outcomes (Hara et al., 2000). In the area of AOD, De Wever et al. (2007) suggest that roles "compel students to focus on their responsibilities in the discussion group and on the content of their contribution" (p. 437), thus increasing student awareness of collaboration and possibly resulting in improved knowledge construction outcomes (Strijbos, Martens, Jochems, & Broers, 2004).

Several roles are commonly used in AOD: a role to begin the discussion; a role that comments on what peers have posted (either by questioning or suggesting further issues); and finally, a role to summarise the contributions at the conclusion of the discussion (De Wever et al., 2007; Duphorne & Gunawardena, 2005). It has been reported that students take role assignment seriously and attempt to take on their assigned roles authentically (De Wever, Schellens, Van Keer, & Valcke, 2008).

One of the earliest studies to employ role assignment in the form of a 'starter' and a 'wrapper' was that of Hara (2000), in which 20 graduate students were involved in four discussions each of one-week duration in a blended course. Content analysis showed evidence of substantial levels of in-depth thinking. The authors speculated, however, that the encouraging results may have been due to the fact that the students in the study were of masters/doctoral level, rather than to the implementation of the 'starter-wrapper' technique, and called for further research to explore the technique in undergraduate level courses.

De Wever, Schellens and colleagues have published several studies exploring the use of role assignment (De Wever et al., 2009; De Wever et al., 2007; De Wever, Van Keer, Schellens, & Valcke, 2010; Schellens, Van Keer, & Valcke, 2005). Their research has largely used first year undergraduates who have assumed four different roles. The levels of knowledge construction demonstrated in the postings of the students performing these roles were compared to the levels of knowledge construction demonstrated in the postings of students not engaged in role assignment. It was found that high levels of knowledge construction were only found in the messages of the summariser role. It was speculated that the task of posting summaries, involving identifying similarities and differences within the discussion, developing an overview of the discussion and considering all presented viewpoints, necessitated the use of advanced knowledge construction skills. De Wever et al. (2009) explored role assignment on discussion groups as a whole compared to groups in which no role assignment was used. Here it was reported that significantly more occurrences in high level knowledge construction were found in the groups using roles compared to those groups without roles. The timing of the introduction of role assignment was also investigated during four separate discussions with some groups having role assignment only during the first two discussions while the other groups had role assignment introduced during the last two discussions. It was reported that the introduction of role assignment at the start of the discussion resulted in more occurrences of knowledge construction for both students performing the roles and those students without a role in the role-supported groups.

Equally important, De Wever et al. (2009) found that when role assignment was dropped from subsequent discussions, higher levels of knowledge construction were

maintained. The researchers thus concluded that the act of performing roles may have an enduring effect on the thinking skills learnt during role assignment. This may imply that if students are able to maintain engaging and active discussion levels after the use of role assignment, instructor support is less needed and may be withdrawn. This situation leaves students as the centres of their own learning, one of the primary aims for which AOD was initially advocated.

The body of research produced by De Wever, Schellens and colleagues (De Wever et al., 2009; De Wever et al., 2007; De Wever, Van Keer, et al., 2010; Schellens et al., 2005) has made important contributions to the use of role assignment in AOD. Their research gives preliminary results showing that, while the actual types of roles used in AOD may be unclear, the use of role assignment, particularly at the commencement of the discussion, appears beneficial when compared to groups without role support. It is interesting to note, however, that a later study by the same researchers (De Wever, Van Keer, et al., 2010) comparing role assignment with the use of postgraduate moderation found that the latter proved superior to the use of role assignment. Clearly there is need for further investigation into the impact of role assignment on AOD, especially if the potential for student-centred learning can be enhanced.

2.5.4 Assessment used in AOD

Assessment is an important part of the educational process for students and instructors. Summative assessment is used for the purposes of grading and is characterised as assessment ‘of’ learning. Formative assessment is used to adapt

teaching and learning to meet student needs, and can be seen as assessment ‘for’ learning (Vonderwell et al., 2007).

The place and form of summative assessment within AOD remains unclear with debate continuing about whether assessment of the AOD postings themselves is essential for successful learning outcomes (Dennen, 2008b; Gulati, 2008; Hara et al., 2000; Hew et al., 2010; McKenzie & Murphy, 2000; O'Reilly & Newton, 2001; Palmer, Holt, & Bray, 2008; Rovai, 2003; Vonderwell et al., 2007; Williams, 2002). Several studies claim that where AOD is not assessed there appears to be little effort to participate, as students do not contribute unless they have to (Hara et al., 2000; Palmer & Holt, 2009; Williams, 2002). Williams (2002) noted that students perceive an optional AOD as work ‘on top’ of normal requirements and so do not bother to participate.

McKenzie and Murphy (2000) stress the need for assessment of AOD, claiming that without it, students will neither visit nor participate in the AOD forum. Their study, which did not include any assessment, indicated that 74% of postings were made by only nine students from a total of thirty enrolled students. Likewise Rovai (2003) suggests grading AOD can motivate students to greater participation. In his study of 262 graduate level students, a significant increase in the number of student messages was reported when discussion contribution accounted for 10-20% of the course grade compared to courses in which discussions were not graded.

On the other hand, O'Reilly and Newton (2001) contend that assessment may not be necessary, arguing that students have an intrinsic motivation to participate in an

AOD regardless of assessment. Additionally, Gulati (2008) questions the use of assessment as contradicting the constructivist principles upon which AOD is based. The lack of consensus about the need for assessment suggests that further research in the area is warranted.

If assessment of AOD is shown to be of potential value, a further issue needing investigation is that of what should be assessed. It has been suggested that rather than directly assess the individual contributions, a more effective strategy may be to employ a culminating task based on the AOD (Dennen, 2008a; Greenlaw & DeLoach, 2003). Dennen (2008a) claims that getting students to produce a reflection paper about their AOD experience "serves as a product documenting what the learner has perceived as his or her own process of learning through the act of discussion" (p. 212). Similarly, Arend (2009) and Richardson and Ice (2010) assert that students need time to absorb, reflect and synthesise the material before evidence of critical thinking can occur. So the introduction of a post-AOD assessment, where students are required to show what they have learnt from the AOD and from their own independent research, may provide a better indication of their learning than participation and contributions alone.

Despite the suggestions of a post-AOD assessment possibly being a better indicator of learning than the actual discussion transcripts, little research has reported on this. Akyol and Garrison (2011) examined the activity in an unassessed AOD and explored how the contributions were used by graduate education students to complete a post-AOD course redesign project assessment. They reported that students believed the final stage of critical thinking, represented by creating and

presenting solutions, could not be attained in the AOD, but instead were applied in the course redesign project. This belief was supported by transcript analysis of the AOD postings which indeed showed little evidence of the final stage of critical thinking having occurred in the AOD. This seems to suggest that students need the extra task of a post-AOD activity to fully engage their critical thinking.

Lea's (2001) study examined how students constructed knowledge in their post-AOD essays using information from the AOD, by focusing on how students integrated material from the AOD with academic resources. Though not specifically identifying the post-AOD essay as the indicative product of learning, she did report that students appeared to use the AOD to stimulate thought and rehearse discipline-based debates, suggesting that the intermediate process of the AOD helped to improve the arguments submitted in the post-AOD essay.

Several studies have examined how having a post-AOD assessment would affect the quality of the AOD, rather than the use of a post-AOD assessment as a possible product of learning (Geer, 2003; MacKinnon, 2004). In the study by MacKinnon (2004), teachers were instructed on the use of computer technology in high schools by having them participate in an AOD which required the use of five quotes from the AOD in a post-AOD essay assessment. It was reported that teachers believed the quoting requirement provided the incentive to promote quality AOD postings, but the study did not report on the post-AOD essay in any way. In Geer's (2003), study students were required to submit a 350-word post-AOD assessment addressing the issue discussed in the unassessed AOD. Contrary to the results of MacKinnon's

study, however, Geer reported that requiring students to complete a post-AOD submission did not lead to deep engagement in the AOD.

In addition to giving students an opportunity to express what they have learnt, the use of a post-AOD assessment may be a sensible and practical approach from an instructor's perspective. Evidence indicates that reading and grading AOD postings is a very time consuming activity (DiBiase, 2004; Lazarus, 2003) and, as Brookhart (2004) noted, "having an assessment that will take more time than you have … is not much help" (p. 11). Dennen (2008a) suggests that in assessing AOD contributions "such extensive message-by-message grading might rapidly become overwhelming for instructors to implement" (p. 7) , especially for large undergraduate courses where the number of postings may be in the hundreds. Research is needed to further explore the value of assessment in an AOD, especially the use of a post-AOD assessment.

Much research has been done on the useful role played by the inclusion of an assessment rubric in education. However, despite suggestions for its inclusion in AOD assessment (Al-Shalchi, 2009; Hazari, 2004; Murphy, 2004b; Penny & Murphy, 2009; Swan, Shen, & Hiltz, 2006; Vonderwell et al., 2007), less research has examined its impact on discussion outcomes. Swan, Schenker, Arnold, and Kuo (2007) reported that the student group that had access to assessment criteria responded both significantly more often and read more of their peers' messages, and that the discussion in this group evidenced more posts, more threads, and a greater depth than the student group that did not have access to the assessment criteria.

Similarly, Wyss, Freedman, and Siebert (2014) found significantly higher discussion scores for the AOD that had received an assessment rubric compared to one that had not. Additionally, it has been reported that students appreciate having assessment criteria as it helps to clarify discussion expectations (Solan & Linardopoulos, 2011; Wyss et al., 2014). More research is needed to substantiate these favourable results.

2.5.5 Moderation used in AOD

Moderation, also commonly called facilitation, can be defined as purposeful postings made to encourage, direct, stimulate and maintain discussion if contributions cease or discussion is waning (Anderson & Kanuka, 1997; Berge, 1995; Garrison & Arbaugh, 2007; Shea, Pickett, & Pelz, 2003; Wang, 2008). As an online moderator, an instructor performs a number of roles: social, administrative and pedagogical (Berge, 1995; Berge & Collins, 2000; Blignaut & Trollip, 2003; Hara et al., 2000; Wang, 2008). The social role includes affective support in encouraging and acknowledging learner participation thus creating a comfortable and friendly environment. The administrative role consists of setting up the AOD, and helping learners with access and technical issues. The most important role, however, is pedagogical, where moderator comments relate to the course content and are directed towards achieving the discussion learning outcomes.

There is no doubt about the importance of moderation in AOD (Andresen, 2009; Garrison, 2007; Hew et al., 2010; Kanuka et al., 2007; Rovai, 2007; Shea et al., 2006). Shea (2006) reported that a strong and active presence of the instructor was a major factor contributing to students' sense of connectedness and learning in the AOD. Mandernach et al. (2009) reported that the key to developing effective critical

thinking lies within the interactivity level of the instructor and the instructor's ability to facilitate course interactions in a manner that prompts high order thought. In a study of 69 undergraduate students, Thomas (2002) concluded that the role of the moderator in an online discussion cannot be underestimated in promoting the coherent and interactive dialogue necessary for conversational modes of learning. Garrison et al. (1999) also found that moderation, or what they termed 'teacher presence', was essential in mediating critical reflection and discourse.

Though moderation has an important role in AOD, there is uncertainty surrounding the quantity of instructor moderation that is optimal (Zhu, 2006). An (2009) compared two forums of undergraduate education students with both forums requiring students to make a minimum of two responses to their peers' postings. The difference in the forums was that in one, the instructor responded to each student's initial message, while in the other the instructor was largely absent. Using both social networking analysis and content analysis, it was reported that in the first forum students tended to respond to the instructor's comment but responded less to one another, while in the forum with little involvement by the instructor, the discussion flowed freely with more interaction both social and on task and students strongly engaging with one another.

A contrary result, however, was reported by Mandernach et al. (2009). When comparing the levels of critical thinking to the amount of instructor involvement, it was reported that students with an inactive instructor scored significantly lower ratings in areas of critical thinking relating to identifying the problem, considering the context, integrating perspectives, and communicating effectively, when compared

to students with an active instructor. The researchers suggested that the key to the development of effective critical thinking lies within the activity level of the instructor. These contradictory results indicate that evaluating the optimal quantity of instructor moderation requires further investigation.

Other research has suggested that the achievement of high level learning outcomes is more dependent on type of moderation than the quantity of moderation. Arend (2009) investigated the type of moderation used by instructors in AOD exhibiting high levels of critical thinking compared with AOD exhibiting low levels of critical thinking. It was reported that instructors in the high critical thinking courses responded less frequently but more impartially to student postings. These instructors would question or extend the discussion and push students to go further in their thinking. The instructors in the low critical thinking courses, on the other hand, responded to almost every student posting, but tended to share their own opinions, use comments that shut down the discussion and seemed to direct thinking towards the 'right' answer. Dennen (2008b) examined moderation in nine courses where instructor presence ranged from forum domination to complete absence, and indicated that the most favourable presence was that which let students know their postings were being read without taking over the discussion. It was concluded that instructors need to relinquish their teaching role and interact more as a peer, rather than remain as the authority.

Though moderation is generally performed by the instructor, not all researchers agree that the instructor should be the moderator. A better option may be to instruct students to become moderators of their own AOD. La Pointe and Gunawardena

(2004) reported that student-student interaction has a higher impact on AOD learning outcomes than student-instructor interaction. Research investigating student moderation has been positive in associating this type of moderation with high order discussion outcomes (Hew & Cheung, 2011; Hew et al., 2010; Rourke & Anderson, 2002; Seo, 2007), while other studies have investigated the impact of facilitation techniques adopted by students (Baran & Correia, 2009; Chan, Hew, & Cheung, 2009; Hew et al., 2010; Wang, 2008; Xie & Ke, 2011).

Several studies have reported that postgraduate students would rather have their peers moderate the AOD than their instructors (Hew & Cheung, 2010, 2011; Rourke & Anderson, 2002). Additionally, it was suggested that the majority of these postgraduates felt they had reflected more in peer-moderated AOD (Hew & Cheung, 2010) and that this type of moderation was more helpful in achieving high order learning (Rourke & Anderson, 2002). This may suggest that a student moderated AOD is more suitable for mature postgraduate students, who are competent in articulating their intentions, rather than for undergraduate students. However, in a subsequent study (Hew & Cheung, 2011) where peer moderation was used with both undergraduate and postgraduate students, it was reported that there was no significant difference between the undergraduate and postgraduate students in levels of knowledge construction.

Different student moderation techniques have been found to have different levels of success (Baran & Correia, 2009; Chan et al., 2009; Xie & Ke, 2011). Chan et al. (2009) examined how four different student-facilitation techniques (pointing, questioning, resolving and summarising) affected thread development in an AOD.

Their results suggested that combining questioning with other facilitation techniques, such as directing, resolving and summarising, appeared to enhance thread continuity, while the use of resolving and summarizing facilitation techniques alone fostered early thread termination. Xie and Ke (2011), in a study of undergraduates, reported that the initial postings of the student moderators set the tone for subsequent discussion; initial postings representing reflective interaction were positively associated with subsequent comments of collaborative elaboration and reflection, while initial postings designating social interaction and simply sharing information resulted in low level engagement among students. Baran and Correia (2009) reported that the facilitation strategies chosen by teachers enrolled in a master's level course generated innovative ideas in the AOD, motivated participation and generally provided a risk-free and relaxed atmosphere. However, these authors suggested the strong teaching background of the students probably influenced them in their choice of facilitation technique, and that students without this background may not have access to these strategies.

These studies indicate that, though there are positive learning outcomes associated with student moderated AOD, the type of technique employed in the moderation influences those outcomes. The exact nature of the moderation techniques, how they should be implemented and by whom need further consideration.

2.5.6 Student characteristics

A range of student characteristics has been identified as influencing participation and discussion outcomes in AOD. These characteristics include learning style (Cunningham-Atkins, Powell, Moore, Hobbs, & Sharpe, 2004; Graff, 2003; Hiltz &

Shea, 2005; Schellens, Keer, Valcke, & Wever, 2007; Schellens et al., 2005), personality (Chen & Caropreso, 2004; Graff, 2003; Kerr, Rynearson, & Kerr, 2006), time management skills (Gerbic, 2006; Hiltz & Shea, 2005), prior online course experience (Thompson & Savenye, 2007), technology self-efficacy (Hammond, 2005; Hiltz & Shea, 2005), gender (Caspi, Chajut, & Saporta, 2008; Mazzolini & Maddison, 2007; Wu & Hiltz, 2004), age (Chyung, 2007; Meyer, 2008), and cultural background (Chiu, 2009; Meyer, 2008; Pisutova-Gerbe & Malovicova, 2009).

Results relating to the effect of learning style in AOD depend on the definition of learning style that is used (Hiltz & Shea, 2005). In their review of studies that examined the effect of learning style on online success, Hiltz and Shea (2005) reported that verbalisers, convergers and abstract/sequential learners (Felder & Silverman, 1988) were most suited to an asynchronous learning environment. On the other hand, Cunningham-Atkins et al. (2004) reported that imagers posted more messages than verbalisers. Using a learning style concept consisting of either a deep or surface approach (Entwistle & Tait, 1990) to learning, Schellens et al. (2007) reported no significant difference in the levels of knowledge construction between students of either approach.

Contrary to the results of research into the effect of learning style, the results relating to the effect of personality on AOD learning are relatively consistent. Kerr et al. (2006) reported that, among a number of student characteristics investigated, independent learning emerged most consistently as the major factor affecting student success in AOD environments. Kerr et al. (2006) used quite an encompassing concept of independent learning defined as one's ability to manage time, balance

multiple tasks, set goals, and possess a disposition of self-discipline, self-motivation, and personal responsibility. Similarly, Chen and Caropreso (2004) reported that students who were more socially outgoing and engaging, and open to sharing intellectual and imaginative experiences, seemed better able to meet the goals of collaborative interaction required in AOD. Graff (2003) reported that sensing-thinkers posted both twice as many messages of twice the length as those students with an intuitive-feeling personality.

Regarding the effect of gender, several studies reported that this made no difference to participation in AOD (Davidson-Shivers, Morris, & Sriwongkol, 2003; Garrison et al., 2010; Wu & Hiltz, 2004), but other studies showed that posting behaviour is different between genders. Barrett and Lally (1999) found that, though males posted both more and longer messages than females, the females' messages were more interactive. On the other hand, Caspi et al. (2008) reported that females posted more than their male counterparts, while Kramarae (2007) found that not only did all-female groups post significantly more messages than all-male groups, but that females tended to use the AOD to foster a sense of belonging and involvement. It was also found that while males were more concerned with technical detail and seeking definitive answers, female responses were more open-ended and related to the big picture (Mazzolini & Maddison, 2002).

The impact of student age on participation and attitudes towards learning in an AOD are difficult to quantify due to differences in definitions of 'younger' and 'older' students or missing definitions altogether (Chyung, 2007). Generally though, it

seems that that older groups post significantly more messages than younger groups (Chyung, 2007; Hiltz & Shea, 2005; Meyer, 2008; Tallent-Runnels et al., 2006).

The question of whether cultural background has an effect on AOD participation has been raised by both Hew et al. (2010) and Hammond (2005). Meyer (2008) found no differences in the number of postings between students of African American or Caucasian heritage. However, it has also been reported that students from a previously rigid authoritarian educational background (Pisutova-Gerbe & Malovicova, 2009) or from a culture alien to student-centred collaboration (Chiu, 2009) required an appropriate pedagogy that introduced them to the interactive dialogue and thinking environment of AOD.

In an attempt to bring together all these student characteristics, Hiltz and Shea (2005) constructed a profile of student attributes and related demographics that are most suited to asynchronous online learning. This profile includes a high motivation to learn, an independent and self-disciplined personality, and good time management skills. Demographic factors include previous online course experience, an above average academic ability, technological access, family and workplace support and, perhaps controversially, being a female over 25 years of age. As can be concluded from the research cited in this section, there appears to be much agreement with elements of this profile.

2.5.7 Technology issues

Technological barriers pose an important risk to learning in any environment as a preoccupation with technical issues diverts attention away from the learning situation

(Andresen, 2009). In the AOD environment, this preoccupation may deter participation resulting in potentially missed learning opportunities (Wu & Hiltz, 2004).

Whereas some early technology issues no longer pose problems, others continue to be a problem while newer issues emerge. Where once issues with slow internet connections, lack of access from home and hardware problems were the focus of attention (Hammond, 2000; Rodrigues, 1999), these have not been mentioned for some years (Gerbic, 2006; Hammond, 2005). Similarly, problems associated with the non-verbal gestures of text-based communications were once actively discussed (Murphy & Coleman, 2004), but are now much less of an issue as students have become more technology literate, along with the availability of ubiquitous mobile devices (Sher, 2009).

However, some technology issues remain. It has been suggested that the discussion environment within traditional learning management systems may not be totally conductive to natural interaction between its users and instead may actually deter participation (Miller, 2013). The format of the threaded forum, requiring students to log into their course, navigate to the AOD space, locate an appropriate thread for posting their contribution, or create a new one, and logout, makes focused discussion difficult (Gao et al., 2013; Vonderwell & Zachariah, 2005). Subsequently, it has been suggested that these problems may be overcome by combining the best of current AOD environments with the features available through social media applications such as Facebook™ (Kent, 2013).

Research investigating the potential use of Facebook™ has reported promising results with a rise in student participation rates (Deng & Tavares, 2013; Harmon, Alpert, & Histen, 2014). However, a new technology issue to emerge is that related to privacy issues when using social media platforms for online discussion. Harmon et al. (2014) concluded their study with a recommendation that students have instruction on how to implement privacy controls when using Facebook™ in an educational setting. Additionally, software usability and adequate levels of technical support continue to be crucial in maintaining student motivation for engaging in online discussions (Deng & Tavares, 2013; Sánchez & Hueros, 2010).

2.5.8 Summary of factors influencing AOD learning

The studies presented in Sections 2.5.1 to 2.5.7 have added to the body of knowledge about learning in AOD and how AOD outcomes may be enhanced, as well as highlighting areas requiring further research. Table 2-3 lists the factors explored in these sections and a brief description of the state of the research on each factor.

Table 2-3: Summary of research results on factors influencing AOD learning outcomes

Factors	Summary of research results
Stating the purpose for an AOD learning activity	Relevance of purpose has been determined but extent of inclusion in AOD is uncertain (Section 2.5.1)
Protocols used AOD	Unclear which protocols are required (Section 2.5.2)
Pedagogical strategies used in AOD:	
Different types of AOD Design	Uncertainty of optimal design for different discussion outcomes (Section 2.5.3.1)
Supporting materials	Strongly encouraged; however, unsure whether students understand or use the materials (Section 2.5.3.2)
Group size	Ten students suggested for each forum, but student feedback suggests smaller sized forums (Section 2.5.3.3)
Questions	Clearly important, but little reporting of types of questions (Section 2.5.3.4)
Message labelling	Useful for undergraduates, but appears to hinder dialogue for postgraduates (Section 2.5.3.5)
Participant role assignment	Mixed results with more research needed (Section 2.5.3.6)
Assessment used in AOD	Contradictory results though a leaning towards assessment, but little reported on the use of a post-AOD assessment (Section 2.5.4)
Moderation used in AOD	Strongly advocated with student moderation as a possibility (Section 2.5.5)
Student characteristics	Highly motivated independent learners are most successful (Section 2.5.6)
Technology issues	Improvements have addressed early concerns, but new issues have emerged and adequate levels of technical support is a continuing problem (Section 2.5.7)

2.6 Overview

This chapter reviewed the literature relating to the research described in this thesis.

AOD was embraced over 25 years ago as it fostered a student-centred approach to

learning within a social constructivist framework. Subsequently, there has been much enthusiasm about what could be achieved in this environment for virtual discussion.

Two of the most important learning outcomes associated with AOD are those of high order thinking and the social construction of knowledge. Research into AOD has shown that both of these outcomes are being achieved in online discussions. However, the extent of this achievement is limited to mostly the lower levels of high order thinking. Studies have called for further research into how student thinking can be moved beyond these low levels and engage in complex cognitive processes in an AOD.

Many factors have been highlighted that may potentially enhance student achievement of desired AOD outcomes. Research into these factors has made significant contributions to understanding how student learning outcomes can be achieved in an AOD. However, results in several areas, for example in the use of supporting materials and assessment, are still inconclusive.

The literature review presented in this chapter has identified several areas for further investigation, and the research described in this thesis aims to make a contribution towards clarifying how best to conduct AOD. The presentation of the first study undertaken as part of the research described in this thesis begins with Chapter 3 where the research questions associated with Study 1 are introduced.

Chapter 3
Study 1 Research Questions

3.1 Introduction

The aim of the research described in the thesis is to investigate how student learning outcomes may be enhanced in structured (AOD). The research focuses on the conditions conducive to quality discussion and factors facilitating student learning. The first study was undertaken to investigate how a range of factors affect the achievement of AOD outcomes.

This is the first of four chapters that describe Study 1 and presents the research questions that form the basis for this study. Answering these research questions will highlight factors that contribute towards the enhancement of learning outcomes associated with an AOD. Section 3.2 presents the major research question for Study 1, with Sections 3.3 to 3.7 presenting the subsidiary research questions relating to each of the factors being examined.

3.2 Research question

As discussed in Section 2.4, research has shown that student learning can be achieved in an AOD environment; however, the extent of the achievement of AOD learning outcomes has been less than initially hoped. Calls have been made for further research into how achievement levels in the AOD learning outcomes of high order thinking skills (Section 2.4.1), the social construction of knowledge (Section 2.4.2), and communication skills (Section 2.4.3) may be

enhanced. Research has suggested a number of factors (Section 2.5) that have been shown to have a positive impact on discussion learning outcomes, but further research is needed into how these factors may improve the levels of achievement in AOD outcomes (Garrison & Arbaugh, 2007; Hew & Cheung, 2010; Hew et al., 2010; Maurino, 2007; Wise & Chiu, 2011). Study 1 was conducted to carry out this research and sought to answer the following research question:

RQ1: What factors enhance discussion outcomes in a structured asynchronous online discussion (AOD)?

A number of subsidiary research questions were identified for investigating the various factors potentially influencing AOD outcome success, and these questions are presented in Sections 3.3 to Section 3.7.

3.3 Providing the purpose for using an AOD as a learning activity

Stating the purpose of the AOD has been shown to contribute to a better understanding of expectations (Ellis & Calvo, 2004), which in turn is positively associated with student satisfaction (Palmer et al., 2008). Instructors have reported that without a stated purpose, students can flounder in the discussion (Dennen, 2005). However, while the benefit of providing the purpose of an AOD is supported by students and instructors alike, its effect on the achievement of discussion outcomes has not been reported. The research undertaken in Study 1, to examine the effect of stating the purpose of the

online discussion on AOD outcomes, sought to answer the following research question:

RQ1.1: How does providing the purpose for an online discussion affect the achievement of AOD outcomes?

3.4 Preparatory sessions

Previous research has suggested that the use of supporting materials in AOD is beneficial (Alexander et al., 2010; Bai, 2009; Gilbert & Dabbagh, 2005); however, it is unclear if students can understand the information in these materials or know how to apply the information when participating in the AOD. Supporting materials, as defined in Section 2.5.3.2, include items such as guidelines, checklists and rubrics designed to assist students in creating thoughtful and reflective AOD contributions. It has been suggested that some sort of interaction with the supporting material prior to the commencement of the AOD is needed to ensure engagement with these materials (Christopher et al., 2004; Greenlaw & DeLoach, 2003; MacKnight, 2000). However, there appear to have been no evaluations of the value of such an activity in the literature.

For the purpose of Study 1, the term 'preparatory session' was used to define instruction held prior to the commencement of the AOD that fosters engagement with supporting materials. Examples of topics covered in such sessions may include any of the following: how to approach the AOD topic; how to develop a persuasive argument through logic and evidence; or what is meant to think critically. The research conducted in Study 1 that examined the

effect of preparatory sessions on AOD outcomes sought to answer the following research question:

RQ1.2: How do preparatory sessions given to students at the commencement of an online discussion affect the achievement of the AOD outcomes?

3.5 AOD protocols

Though there is consensus about the need for AOD protocols (Dennen, 2005; McKenzie & Murphy, 2000) there is little research about what these protocols should entail. Protocols used in an AOD may be considered those rules and deadlines, issued at the beginning of an AOD, that state the requirements for the discussion (Gilbert & Dabbagh, 2005). Contradictory results have been reported about the value of specifying a minimum number of required postings (Biesenbach-Lucas, 2004; Hara et al., 2000; Murphy & Coleman, 2004), while restricting posting length has been shown to have a negative impact on the cognitive quality of student postings (Gilbert & Dabbagh, 2005). There is a clear need for further research into the use of rules and deadlines associated with AOD.

Due to the lack of research into the AOD protocols of implementing a discussion duration, and the specification of a minimum number of required postings[1] on AOD outcomes (Hew & Cheung, 2011), the research undertaken

[1] A required posting excludes postings of short comments such as "I agree".

in Study 1 sought to answer the following research questions about these specific protocols:

RQ1.3: How does the implementation of a set duration for an online discussion affect the achievement of AOD outcomes?

RQ1.4: How does the stipulation of a minimum number of required postings in an online discussion affect the achievement of AOD outcomes?

3.6 Assessment

Assessment is an important part of the educational process both for students and instructors. As discussed in Section 2.5.4, there are two major issues of debate surrounding assessment in AOD: firstly the necessity for assessment (Gulati, 2008; McKenzie & Murphy, 2000; O'Reilly & Newton, 2001; Rovai, 2003); and secondly, what should be assessed and how it should be assessed (Arend, 2009; Dennen, 2008b; Greenlaw & DeLoach, 2003).

Having the AOD postings graded and contributing a percentage towards the final mark for the course is the most commonly employed form of assessment in this environment (Dennen, 2008a). This form of assessment will be called AOD contribution assessment throughout the remainder of this thesis.

Some studies suggest that assessment is a necessary incentive for participation in the AOD (Hara et al., 2000; McKenzie & Murphy, 2000; Palmer & Holt, 2009; Rovai, 2003; Williams, 2002), while other studies argue that assessment

is unnecessary as students have an intrinsic motivation to participate in an AOD regardless of assessment (Gulati, 2008; O'Reilly & Newton, 2001). The research conducted in Study 1 that examined the effect of assessing the online discussion contributions on AOD outcomes sought to answer the following research question:

RQ1.5: How does the use of assessment in an online discussion affect the achievement of AOD outcomes?

Even if assessment is found to be desirable with an AOD, perhaps assessing the discussion contributions may not be the optimal form of assessment. As suggested in Section 2.5.4, students need time to absorb, reflect and synthesise material before evidence of high order thinking can occur (Richardson & Ice, 2010). Additionally, grading AOD contributions is very time-intensive and it is difficult to distinguishing fine gradations between postings (Dennen, 2008a). A more effective strategy may be to employ an assessment based on the AOD, rather than grade the contributions themselves (Geer, 2003; Lea, 2001). This form of assessment will be called post-AOD assessment throughout the remainder of this thesis. The research undertaken in Study 1 that examined the effect of using a post-AOD assessment on AOD outcomes sought to answer the following research question:

RQ1.6: How does having a post-AOD assessment based on the online discussion affect the achievement of AOD outcomes?

A rubric helps to convey expectations of a learning activity and, despite evidence that an assessment rubric results in improved student learning (Wyss

et al., 2014), its value in AOD does not appear to have been widely investigated. The research conducted in Study 1 that examined the effect of an assessment rubric on AOD outcomes sought to answer the following research question:

RQ1.7: How does providing an assessment rubric for an online discussion affect the achievement of AOD outcomes??

3.7 Moderation

Moderation is seen as an important intervention for promoting the coherent and interactive dialogue necessary for learning (Garrison, 2007; Mandernach et al., 2009). However, as discussed in Section 2.5.5, there is uncertainty about the type and amount of intervention that encourages participation and active engagement in an AOD and about who should perform this moderation. Moderation appears to be most commonly performed by teaching staff, but studies using students to perform peer moderation have reported some encouraging results (Baran & Correia, 2009; Hew et al., 2010; Xie & Ke, 2011). There is a paucity of research that directly addresses student moderation compared to instructor moderation (Hew et al., 2010).

An issue which does not appear to have been examined in the literature is that perhaps more than one moderator is needed to perform the various types of intervention typical in an AOD. For example, comments steering the discussion in a particular path may be better suited to instructors, while summarising the discussion may be better suited for student moderation.

Research is needed to investigate these issues surrounding moderation in AOD. The research conducted in Study 1 that examined the effect of moderation on AOD outcomes sought to answer the following research question:

RQ1.8: How does the person performing the different moderation tasks affect the achievement of the AOD outcomes?

3.8 Overview

This chapter is the first of four chapters describing Study 1 and presented the research questions for this study. The aim of the research described in this thesis is to gain a better understanding of how to enhance the achievement of learning outcomes in a structured AOD. This aim was addressed by investigating factors and conditions conducive to quality discussion that facilitate student learning.

The starting point for this investigation was to identify factors potentially influencing AOD outcomes. Study 1 was designed to carry out this investigation, by examining the impact of a range of factors on discussion outcomes associated with high order thinking, the social construction of knowledge, and student communication skills. The following factors were examined in Study 1: providing the purpose for an AOD, using preparatory sessions, implementing several AOD protocols, and using assessment and moderation in an AOD.

The following chapter describes the methodology employed in Study 1.

Chapter 4
Study 1 Method

4.1 Introduction

Study 1 was an exploratory study undertaken to investigate the effect of a range of factors on the achievement of AOD outcomes and in order to answer the research questions that were presented in Chapter 3. This chapter describes the methodology used for Study 1.

The research design is first described in Section 4.2 along with the reasons for its choice. Section 4.3 describes the participants used in Study 1, while the procedure followed in Study 1 is detailed in Section 4.4. The development of the measurement instrument along with the items contained in the questionnaire is presented in Section 4.5, and the data analysis used for the information collected in Study 1 is described in Section 4.6.

4.2 Research design

The research conducted in Study 1 involved investigating a range of factors potentially influencing discussion outcomes. A survey design was chosen because opinions were sought from instructors teaching in a range of disciplines in a variety of countries. Instructors from various countries Study 1 used a cross-sectional survey design with a self-administered online questionnaire as the data collection method.

A cross-sectional survey was used because it provides a 'snapshot' of particular aspects at a certain time (Creswell, 2008). In the case of Study 1, these were the perceptions of instructors about their use of AOD in their teaching. An online questionnaire enables easy access to a large geographically dispersed sample at a relatively low cost and small time investment (Oates, 2006). Additionally, provided care is taken in the creation of self-administered online questionnaires, they are easy to complete at a time convenient to participants, thus improving response rates (Evans & Mathur, 2005).

4.3 Participants

In implementing an AOD, instructors themselves are the instigators of initiatives that they consider influential in the achievement of AOD learning outcomes. Instructors, therefore, are well placed to identify factors that they have found to have a substantial impact on AOD outcomes. However, although many studies researching AOD investigate the student perspective, there has been relatively little research that investigates the instructor perspective (Beebe et al., 2010; Maurino, 2007; Mortera-Gutierrez, 2002). Study 1 was conducted to address this gap in the literature.

To obtain a wide representation of instructors using AOD, Australian and international universities were targeted as well as a local university. The electronic mailing lists of ASCILITE (Australian Society for Computers in Learning in Tertiary Education), ODLAA (Open and Distance Learning Association of Australia), IRMA (Information Resources Management Association), AIS (Association for Information Systems), and the internal LMS

mailing list for the local university were used to recruit potential participants. These electronic mailing lists were chosen as they include members with an interest in e-learning. It was expected that instructors with an interest in education and technology would be the most likely users of AOD, and that the results of Study 1 would be of interest to them, and so they were targeted as potential participants willing to contribute information for the study.

4.4 Procedure

Ethics approval was granted by the university human research ethics committee prior to conducting the survey (permit number 2005/301). The survey instrument was placed on a server in August 2006. All administrators of the targeted mailing lists were subsequently contacted via email informing them of the study and requesting that the study information, together with the invitation to participate, be sent to their members.

The email inviting participation in the survey stated the purpose of the study and how the results from the study aimed to identify factors contributing to the successful achievement of learning outcomes for AOD (see Appendix C). The email included information about the confidentiality of all information, contact details of the researchers, and the URL for the results of the study when available. Finally, a link was given to open the questionnaire.

Several weeks after the questionnaire was made available, a reminder was sent to prompt for further participation. A total of 150 responses were gathered from the survey over the eight week period in which the questionnaire was

available. The collected data was removed from the server in early October 2006, saved in a .csv file and imported into SPSS™ for statistical analysis.

4.5 Instructor questionnaire design

Based on the AOD literature presented in Chapter 2, and applying guidelines for questionnaire design (Benson & Clark, 1982; De Vaus, 2002; Foddy, 1993; Zikmund, 1997), an extensive questionnaire targeting instructor perceptions of use and success of AOD was developed.

The questionnaire consisted of 52 questions, with a combination of closed and open-ended items. See Appendix D for the complete questionnaire. Questions were created in each of the following categories:

- Background information on use of AOD
- Use of AOD protocols and what information about the AOD was provided to students
- Preparatory sessions
- Assessment
- Moderation
- Achievement of AOD learning outcomes
- Demographic information about participants

The main unit of analysis was the last course in which the instructor had used an AOD for teaching purposes. The option to include subsequent email contact

for the instructors was included for possible clarification of questionnaire responses, but not ultimately required.

The questionnaire was pre-tested and piloted to ensure validity. This was done by seven academic staff from the researcher's university: five instructors and two staff members from the teaching and learning department. Four of the five instructors had used AOD for over five years with the remaining academic having used AOD for two years. The two staff members from the teaching and learning department had extensive experience with conducting university-wide surveys, and held professional roles in advising academics about online teaching. The following minor changes were made to the questionnaire based on the feedback received: rearranging the sequence of questions to improve flow; adding instructions to streamline navigation; and amending ambiguous or unclear statements.

The time taken to complete the questionnaire in the pilot study was confirmed at 15-20 minutes, thus ensuring an optimal balance between content coverage and respondent burden (Fink, 1998; Wilkinson & Birmingham, 2003).

4.5.1 Background information on use of AOD

The first section of the questionnaire asked instructors about their use (or non-use) of AOD. The questions in this section also served to filter participants into those who had never used AOD, those who had used AOD in the past but no longer did so, and those currently using AOD. Questions were included for participants to indicate the reason(s) for their non-use/discontinued use of

AOD, with optional fields for entering reasons other than those listed in the questions.

For those instructors currently using AOD the following information was collected: length of time AOD had been used; AOD software used; units/courses in which AOD had been implemented; and country in which teaching took place.

AOD may be used in a variety of ways (Curtin, 2002; Garrison et al., 1999; Rovai, 2007; Yang et al., 2008), with assigned topic discussion being possibly the most commonly used form of structured AOD (Richardson & Ice, 2010). A question was designed to identify the different ways in which an AOD was used as shown in Table 4-1.

Table 4-1: Questionnaire item for different ways in which AOD may be used

Online discussions can be used in variety of ways. Please tick any of the following which apply in your use of the online discussion tool: ☐ Information service about administrative unit/course matters ☐ Forum for students to exchange information freely amongst themselves about any aspect of the unit/course ☐ Forum for discussion of assignments/assessments between students and instructors ☐ Feedback for students after completion of assessments ☐ Discussion of assigned topic/s ☐ Other use – please describe

As the research described in this thesis focused on the use of structured AOD, this question served a second purpose of filtering participants so that only those

who had used structured AOD would continue with the questionnaire. Those instructors who had only used unstructured AOD were directed to the final section of the questionnaire where demographic information of the participant was collected.

4.5.2 Use of AOD protocols and information given to students

Several questions were created for collecting information about whether the purpose for using an AOD was provided to students and which AOD protocols were implemented. When asked about including the purpose for using an AOD, several examples of purpose, such as the development of thinking skills, were included for illustration.

The questionnaire collected information on two AOD protocols. Firstly, participants were asked whether they had implemented a set duration for an AOD and, if so, they were requested to enter the number of days for the online discussion. Secondly, participants were asked whether a minimum number of required postings was implemented and, again if so, they were requested to enter the number of minimum postings required.

4.5.3 Preparatory sessions

Information on preparatory sessions was collected using a question asking participants whether they had used such sessions or not. If they had done so, they were asked to describe the contents of the session. Several examples describing possible content for instruction was included in the question: techniques on how to deconstruct the discussion topic by defining the

significant words in the topic; developing a persuasive argument using logic and evidence; explaining what is meant by ‘critical thinking’ and how it is applied; and showing how evaluation and synthesis are used to formulate conclusions.

4.5.4 Assessment

Assessment may be either summative, which is used for grading and contributing to the final mark for the course, or formative, which is used to adapt teaching and learning to meet student needs. The distinction between these two forms of assessment was explained in the questionnaire, and summative assessment was subsequently represented by the term assessment, while formative assessment was represented by the term evaluation. The item used to collect information about assessment (see Table 4-2) catered for the possibility of instructors using both assessment and evaluation, or neither. An option was also included to collect information on the possible use of an assessment subsequent to the AOD.

When using assessment, an assessment rubric may be provided together with exemplars of expected quality of work. Several items were created asking instructors whether they had given students information on how the AOD was to be graded and if exemplars were given.

Table 4-2: Questionnaire item relating to the use of assessment

Discussion contributions may be assessed or evaluated, both assessed and evaluated or neither. Assessment means that the contributions are marked and graded, and are a component of the formal assessment for the unit. Evaluated means that discussion contributions are examined to determine the usefulness or relevancy of the discussion, but no formal mark is attached to the actual discussion contributions. Some instructors do not assess the discussion postings but use the contributions to form the basis for a follow up assessment (eg. the submission of an individual report summarising the main points from the online discussion). Please tick all that apply: ☐ The discussion contributions were neither assessed nor evaluated ☐ The discussion contributions were evaluated (ie. feedback obtained but not assessed) ☐ The discussion contributions were assessed ☐ The discussion contributions form the basis for subsequent assessment

4.5.5 Moderation

Two aspects of moderation were examined in Study 1: different types of moderation tasks; and by whom the moderation was performed. Moderation tasks have been classified in a number of ways (Berge, 1995; Blignaut & Trollip, 2003; Hara et al., 2000; Hew & Cheung, 2008; Ng, Cheung, & Hew, 2012; Wang, 2008). Based on this literature, information on the moderation tasks listed in Table 4-3 was sought in the questionnaire.

Table 4-3: Moderation tasks listed in the questionnaire items

Rewording the original question when contributions are going off track
Providing additional comments to promote further discussion
Providing regular discussion summaries
Censorship regarding inappropriate postings

Though teaching staff are usually responsible for moderating an AOD, positive results have been reported when students have performed moderation (Baran & Correia, 2009; Hew et al., 2010; Xie & Ke, 2011). The research described in Study 1 investigated moderation performed by an instructor or tutor (teaching assistant), nominated student/s, or group self-moderation where any of the students are free to engage in any type of moderation task as they see fit, without interference or prompting from teaching staff. A similar description was given in the questionnaire.

Table 4-4: Example of a moderation item combining the moderation task with who performed the moderation

Activity: Rewording the original question when contributions are going off track. For this activity I have used mostly: □ Instructor/tutor/teaching assistant moderation □ Student moderation □ Group self-moderation □ Moderation not applicable I have found this form of moderation to be: (1: not successful – 7: highly successful)

Questions were created for each moderation task and instructors were asked to indicate whom they had used to perform the task. For each of these questions, participants were also asked to indicate how successful each kind of moderation was, using a seven point scale, with 1 being, 'not successful' and 7 representing 'highly successful'. An example of a moderation question is shown in Table 4-4, and identical questions were created for each of the other moderation tasks listed in Table 4-3. To cater for the possibility that instructors used a moderation task other than those listed in Table 4-3, an additional item

was created. This item was identical in format to the other moderation questions, but allowed the participant to enter a moderation task.

Due to the importance the literature places on moderation (Andresen, 2009; Garrison, 2007; Hew et al., 2010; Kanuka et al., 2007; Rovai, 2007; Shea et al., 2006), an additional item was included, similar in format to the individual moderation items, investigating the overall contribution of moderation to the success of the AOD. This item is listed in Table 4-5.

Table 4-5: Questionnaire item addressing the overall success of moderation

Please indicate the extent to which you feel moderation overall has contributed to the success of the online discussion: (1: moderation contribution has been insignificant – 7: contribution has been highly significant)

4.5.6 The achievement of AOD outcomes

Three learning outcomes are often associated with AOD: high order thinking (Christopher et al., 2004; Hara et al., 2000; Mason & Kaye, 1990); the social construction of knowledge (De Wever, Keer, Schellens, & Valcke, 2010; Gunawardena et al., 1997; Kaye, 1991); and improved communication skills (Feenberg, 1989; Hiltz, 1990; Pena-Shaff & Nicholls, 2004). Single items were used to measure the discussion outcomes associated with the social construction of knowledge and communication skills, with a one-to-one correspondence with the listed item. Four items were used to measure the range of thinking skills commonly claimed as benefits of an AOD (Akyol &

Garrison, 2011; Bradley et al., 2008; Darabi et al., 2011; Kanuka, 2011; Kay, 2006; Schrire, 2004). All of these items are listed in Table 4-6.

Table 4-6: The measurement of AOD outcomes

AOD outcomes	Items listed in the questionnaire
Low order thinking	Promoted more thought about the topic under discussion
Middle order thinking	Increased student awareness of differing perspectives Enhanced deeper levels of student thinking
High order thinking	Developed critical analysis and reflection in students
Social construction of knowledge	Improved student learning through the collaborative construction of knowledge
Communication skills	Improved student communication skills

The item *promoted more thought about the topic under discussion* reflects the AOD outcome of low order thinking, and refers to the extent that students are discussing and thinking about the topic. The posting of new information in the AOD implies that students are researching the topic and hopefully, in turn, thinking about the issue under discussion.

The ability to see a situation from another's perspective is to show empathy towards that perspective, and understand the other person's point of view. Developing empathy involves exploring and examining the new information drawing on one's analytical skills in order to draw out different viewpoints. The item, *increased student awareness of differing perspectives*, reflects the AOD outcome of middle order thinking, and refers to a movement away from

low order thinking, but thinking not yet representative of high order thinking. Similarly, the item *enhanced deeper levels of student thinking* also reflects the AOD outcome of middle order thinking and refers to the initial use of evaluation skills for assessing the different perspectives, but not yet showing synthesis or proposing solutions.

The item *developed critical analysis and reflection* reflects the AOD outcome of high order thinking and refers to engaging in a discussion at a very high level, critically assessing what peers are saying, and evaluating what has been written. Students discussing solutions, supporting their conclusions with evidence from their readings or personal experience, as well as being able to identify flaws in the conclusions made by their peers.

Participants were asked to rate the achievement of each item, representing the AOD outcome, in their AOD on a scale of 1 to 7. A score of 1 indicated 'not successful' and 7 corresponded to 'highly successful'. Alternatively, participants could indicate that the item was not relevant to their situation.

4.5.7 Demographic information about participants

Participant background information was collected at the end of the questionnaire from all participants (including those who had not used AOD or who had discontinued use of AOD). Information collected here included the teaching background of the participants, a self-evaluation of their computer skills and any professional development or training they had received in AOD teaching. Instructor age and gender information were also collected.

Questions were also created to collect information about the amount of time required to complete several tasks often associated with AOD. These included time spent in preparing an AOD topic, including creating the questions surrounding the discussion topic and locating the readings. Participants were also asked to indicate how much time they spent in moderating an AOD and in marking AOD contributions for assessment.

4.6 Data analysis

The primary data analysis was quantitative as the questionnaire consisted mainly of scale-type questions. Some qualitative analysis was used for data collected in the open-ended questions.

Quantitative data were analysed using IBM SPSS Statistics 21™. Descriptive statistics such as means, minimum, maximum and frequencies were used for the background information on AOD and the demographic information about participants.

Prior to performing inferential analysis, the data sample was tested for normality both visually, using histograms, and objectively, using the Shapiro-Wilk test (D'Agostino, Belanger, & D'Agostino, 1990; Shapiro & Wilk, 1965). As the sample was found to be not normally distributed, nonparametric testing was employed. The Mann-Whitney U test was used to evaluate any differences in the perceived discussion outcomes between groups. This test was used for most of the factors investigated in Study 1. In the case of different assessment approaches where more than two groups were compared, the Kruskal-Wallis

test was used as the alternative to the parametric one-way ANOVA. A significance level of 0.05 was used for all of these tests.

Qualitative data analysis was performed for the questions that included an open-ended item, the majority of which consisted of short descriptions or reasons relating to the associated question. An item towards the end of the questionnaire invited participants to enter comments about their experiences or thoughts on AOD. A categorising strategy for the coding was used for the analysis of this information by entering all the data into a spreadsheet file, where responses to each item were examined and emerging themes identified (Maxwell, 2005).

4.7 Overview

This chapter described the design of Study 1, an exploratory study undertaken to investigate the impact of a range of factors potentially influencing discussion outcomes. The research undertaken in Study 1 focused on the use of a structured AOD for assigned topic discussion. Australian and international online instructors were invited to participate in the study and share their experience of using AOD in their teaching.

Study 1 used a cross-sectional survey design with a self-administered online questionnaire to collect the information needed to answer the research questions related to this study. This information consisted of instructors' perceptions of the impact of a range of factors on the achievement of discussion outcomes.

The chapter included a full description of each of the questionnaire items, and concluded with a description of the data analysis approach used. The following chapter presents a detailed discussion of the results of this survey.

Chapter 5
Study 1 Results

5.1 Introduction

This chapter reports the results of the Study 1 data collection and subsequent data analysis as described in Chapter 4. Section 5.2 presents a profile of the participants, followed by their AOD usage in Section 5.3. The information needed to answer the research questions for the current study is presented in Sections 5.4 to 5.9 where each of the targeted factors is addressed. Each of these sections presents the influence of the specific factor on the discussion outcomes as perceived by those p articipants who had used structured assigned topic AOD. This is followed by a summary of the significant results in Section 5.10.

5.2 Participants

The Study 1 questionnaire was completed by 148 participants[2], hereafter called instructors, of whom 72 (49.7%) were female, and 73 (50.3%) were male. Ages ranged from a minimum of 23 to a maximum of 66 years, with an average of 44.79 years (Table 5-1). Instructors taught undergraduate and postgraduate students in a wide variety of disciplines including business studies, computer science, education,

[2] The questionnaire was actually completed by 150 participants; however, two responses were considered invalid and subsequently the information was withdrawn from the analysis. The first invalid response was a duplicate entry and the other response had been answered from a student's perspective during the participant's postgraduate studies. The participant also indicated that they had never used an AOD for teaching purposes. Thus all data analysis was performed on the information provided by the 148 valid participants.

environmental studies, health studies, humanities, information systems, legal studies, library studies, science and veterinary studies. Thus the information collected in the survey was representative of typical institutions of higher education.

Instructors were invited to self evaluate their level of computer skill. As can be seen from Table 5-1, the results show a relatively high level of computer skill with a mean of 5.91 (out of 7).

Table 5-1: Age and computer skill level of instructors

	N	Mean	Minimum	Maximum	SD
Age (years)	142	44.79	23	66	10.18
Computer skill levels (/7)	145	5.91	2	7	1.17

On the other hand, instructors reported having had relatively low levels of training and professional development in AOD. The mean for training in AOD software was 3.13 and for professional development in using AOD to enhance student learning outcomes the mean was 2.57 (Table 5-2).

Instructors had taught in tertiary education for a minimum of one semester to a maximum of 30 years. Forty two (28.0%) of these instructors reported having also taught in the school system. Fifty instructors (33.8%) reported having a teaching qualification, 18 instructors (12.2%) reported their PhD as their teaching qualification, and 80 instructors (54.0%) reported not possessing a teaching qualification.

Table 5-2: Professional development of instructors

	N	Mean	Minimum	Maximum	SD
Level of professional development in using online discussion software (/7)	144	3.13	1	7	1.72
Level of professional development in using online discussion in using AOD to improve student learning outcomes (/7)	145	2.57	1	7	1.72

Seventy-nine instructors (53.4%) used assigned topic AOD and 69 (46.6%) did not. Those who had used assigned topic AOD, and so were of primary interest for the research described in this thesis, taught in a wide range of disciplines similar to those listed above. Forty seven of these instructors (31.8%) taught in Australia, 25 (16.9%) in the United States of America, and the remainding 76 instructors (51.3%) had taught in New Zealand, Canada, Hong Kong, Finland, Italy, Jordan, Sweden and Uganda. These instructors reported a minimum of 4 to a maximum of 800 students enrolled in their courses, with a mode of 20 students.

In the use of AOD for assigned topic discussion, 54 instructors (68.4%) indicated that they used the assigned topic format as described, while 25 (31.6%) reported having used an alternative format. These alternative formats ranged from open-ended discussion where topics were raised by students to more structured formats, using specific strategies such as:

> A clinical case is provided with questions that the students in private groups answer and formulate a group answer which is reviewed and formative feedback provided back to the group. After this the students develop their own case and questions and answers and moderate their own discussion of their case for summative assessment.

The instructors were asked how much time they had spent on three aspects of AOD: preparing the AOD topic; managing the AOD; and moderating the AOD. On preparing the AOD topic, instructors spent a minimum of 0.5 hours to a maximum of 40 hours with a majority of 53 instructors (75.7%) indicating this task was completed in 5 hours or less. For the management of the AOD in a typical week, instructors spent a minimum of 0.5 hours to a maximum of 20 hours, with a majority of 62 instructors (82.7%) reporting spending 5 hours or less for this task. Similarly, for the time spent on moderation of the AOD in a typical week, instructors spent a minimum of 0.5 hours to a maximum of 20 hours. However, an overwhelming majority of 59 instructors (90.8%) reported spending 5 hours or less on moderation.

5.3 AOD usage

5.3.1 Software used for AOD

Instructors had used online learning management system (LMS) software for a minimum of 6 months to a maximum of 13 years, with a mean of 4.34 years. The most commonly used software for AOD was WebCT™ as reported by 87 instructors (60.4%), followed by Blackboard™ used by 38 instructors (26.4%)[3]. Thirty nine instructors (27.1%) used alternative software products, including Collabra™, Moodle™, Yahoo groups, MSN Messenger™, Desire2Learn™, WebTeach™, Angel™ and Lotus LearningSpace™.

[3]The two separate companies owning WebCT LMS software and Blackboard LMS software merged in February 2006 with the subsequent use of WebCT being phased out and replaced with new versions of Blackboard. However when Study 1 commenced in August 2006, many universities were still using WebCT LMS software, and the two companies were still commonly perceived to be separate entities. As such the results from the survey have been reported accordingly.

5.3.2 Reasons for using AOD

Instructors used AOD for a variety of purposes, such as administrative, course content related and teaching. The most common usage, indicated by 104 instructors (72.2%), was for allowing students to freely exchange information about any aspect of the course. The AOD tool was used as a helpdesk for administrative purposes by 93 instructors (64.6%) and for information exchange about course assessments by 92 instructors (74.8%). As reported in Section 5.2, 79 instructors (54.9%) had used an AOD for assigned topic discussion, while 47 instructors (32.6%) used the discussion space to provide feedback on assessments. Forty-seven instructors (20.1%) indicated other uses which included social networking, group work, discussion of case studies and clinical experience, research and clarification of course material.

Instructors' comments reflected the benefits of the above uses for AOD especially for communicating with distance education students and generally sharing information among all students: "I certainly think that they help distance education students to feel more involved/less isolated in a subject", "I think the potential is huge especially for the distance education sector" and "The [distance education] students really enjoyed them". There was also support for sharing amongst all students: "a great tool for the students to share information and ideas", "very useful for student communication both between us and them and the students themselves", and "I love the way a community of learning develops and students help one another". Finally, one instructor's detailed comment highlights the sense of community created via the AOD:

> Asking students to post an introduction at the beginning of the semester has been a particularly useful exercise and works extremely well to build a sense of community and connection for distance education students. It

> sets the conditions for students to engage in conversation with one another rather than just lecturer/student, and it also gives me a wonderful sense of the diversity and the particular situations of the students that I never meet face-to-face.

Most of the comments about AOD usage were positive such as: "I found the online discussions to be extremely interesting and fruitful. The students really enjoyed them.", "[AOD] helps build an online community of learners and enables students to construct knowledge for and amongst themselves", "have had very positive results with online discussion forums", and "HUGE time saver…allows me (or other class members) to answer common questions quickly and conveniently".

5.3.3 Reasons for non-use of AOD

Nineteen instructors reported never having used AOD, with 11 instructors citing being unsure of how AOD could be incorporated into teaching. Two instructors indicated that AOD was not applicable for their teaching, while one instructor reported negative feedback about AOD. Of the five instructors who cited 'other' reasons for not using AOD, two of these commented on the time consuming and labour intensive task of monitoring the discussion and questioned its benefits. Another respondent alluded to a legal problem stating that, "legal responsibility for monitoring and correcting errors appals me", while others stated they were "not yet up to speed with it" and another reported software issues: "the software has a LONG way to go before it can substitute effectively for face to face communication".

Of the 129 instructors who had reported using AOD, 17 of these indicated that they were no longer using it. Eight instructors reported no longer using AOD because they found it *too time consuming to keep track of and read discussions*, while three

instructors reported *inappropriate postings and/or use by students.* Representative comments related to these reasons include: "conducting effective online discussion has tended to be very time consuming", and "online discussions sometimes got out of hand and I've had students apologize for the writings of other students". Three instructors indicated assessment issues with AOD while two instructors indicated that AOD was not suitable to their current teaching. Instructors indicating other reasons for no longer using AOD included "not currently teaching", "lack of evidence of learning", and "lack of participation by students". Several instructors reported having since moved to alternative environments such as email, synchronous chat and face-to-face discussion.

As the focus of the research described in this thesis is on the use of structured AOD for assigned topic discussion, the remainder of this chapter considers only the information from the 79 instructors who used AOD in this way[4].

5.4 Providing the purpose for an AOD

Stating the purpose for an AOD has been shown to contribute to a better understanding of expectations (Ellis & Calvo, 2004), which in turn is positively associated with student satisfaction (Palmer et al., 2008). Table 5-3 shows the number of instructors who had provided the purpose for an AOD and those who had not, together with the means and standard deviations for levels of achievement in each of the discussion outcomes. To evaluate any differences in the perceived

[4]The demographic information of gender, age, computer skill, teaching experience and professional development (as presented in Section 5.2) has not been presented for this subset of 79 instructors, as there was no significant differences between this group and those that used unstructured AOD.

discussion outcomes between instructors who had provided AOD purpose and those who had not, the Mann-Whitney U test was used. The use of this nonparametric test ensured that violations of the assumptions of the t-test, identified in preliminary assumption testing, did not impact on the interpretation of the results. A significance level of $p < 0.05$ was established.

Table 5-3: Comparison of AOD outcomes for those AOD that had been given the AOD purpose versus those who were not

	Purpose provided			No purpose provided		
AOD Outcomes	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Promoted more thought about the topic under discussion	43	6.16	1.31	35	5.54	1.421
Increased student awareness of differing perspectives	42	6.26	1.13	33	5.06	1.50
Enhanced deeper levels of student thinking	43	5.88	1.33	34	5.00	1.41
Developed critical analysis and reflection in students	41	5.56	1.45	34	4.65	1.52
Improved student learning through the collaborative construction of knowledge	43	5.77	1.48	34	4.88	1.84
Improved student communication skills	40	5.60	1.36	31	4.65	1.66

Providing information about the purpose of the discussion was shown to have a significant positive impact on the achievement of all discussion outcomes: *promoted more thought about the topic under discussion*, (*Mdn* = 7 versus *Mdn* = 6), *U* = 522, z = -2.458, p = .014, *increased student awareness of differing perspectives* (*Mdn* = 7 versus *Mdn* = 5), *U* = 335, z = -3.992, *p* < .001, *enhanced deeper levels of student*

thinking (*Mdn* = 6 versus *Md* = 5), *U* = 418, z = -3.329, *p* = .001, *developed critical analysis and reflection in students* (*Md* = 6 versus *Mdn* = 5), *U* = 435, z = -2.780, *p* = .004, *improved student learning through the collaborative construction of knowledge* (*Mdn* = 6 versus *Mdn* = 5), *U* = 491, z= -2.533, *p* = .011 and *improved student communication skills* (*Mdn* = 6 versus *Mdn* = 5), *U* = 400, z= -2.621, *p* = .009.

5.5 Using preparatory sessions

A preparatory session is held prior to the commencement of the AOD, and fosters engagement with supporting materials. It may include instruction on critical thinking concepts, argument development or creating effective discussion contributions. In the current study, 17 instructors (21.5%) reported using such sessions. Several instructors indicated that these sessions were part of a lecture. Others did not indicate where the session was held, commenting instead on the content of the session: "information on reflective practice", "I give background to [AOD] topic and hints" and "describing a good posting, [with the] expectation that it should be analytical rather than descriptive". One instructor highlighted the importance of good questions commenting that, "We tried to think together how to ask good questions about the articles that were read" while another focused on high order thinking saying "discussion of higher order learning objectives - analysis, evaluation, synthesis…discussion [about] developing and supporting logical arguments [and] on representing views of multiple stakeholders." Several instructors indicated they held interactive sessions that were "example and practise", "introductory, hands-on [sessions]" and "practice session followed by [students] marking their answer in the

session". Finally, one instructor used "a series of orientation sessions that assist students to develop good online group dynamics".

Table 5-4 provides summary information for each of the discussion outcomes for instructors who had used preparatory sessions at the commencement of an AOD compared to those instructors who had not used any of these sessions. The nonparametric Mann-Whitney U test was used to evaluate any differences in the perceived discussion outcomes for those AOD that had used preparatory sessions and those that did not.

Table 5-4: Comparison of AOD outcomes for those AOD that had preparatory sessions versus those that did not

	Preparatory sessions used			No preparatory sessions used		
AOD Outcomes	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Promoted more thought about the topic under discussion	17	6.35	1.06	61	5.75	1.46
Increased student awareness of differing perspectives	16	6.19	1.22	58	5.60	1.47
Enhanced deeper levels of student thinking	16	6.00	1.10	61	5.36	1.48
Developed critical analysis and reflection in students	16	5.88	1.31	59	4.95	1.55
Improved student learning through the collaborative construction of knowledge	16	5.88	1.31	59	4.95	1.55
Improved student communication skills	16	5.88	1.56	55	4.98	1.56

Providing preparatory sessions was shown to have a significant positive impact on the achievement of three discussion outcomes: *developed critical analysis and reflection in students* (*Mdn* = 6 versus *Mdn* = 5), *U* = 290, z = -2.423, *p* = .015, *improved student learning through the collaborative construction of knowledge* (*Mdn* = 6.5 versus *Mdn* = 6), *U* = 318, z= -2.196, *p* = .028 and *improved student communication skills* (*Mdn* = 6 versus *Mdn* = 5), *U* = 279, z= -2.279, *p* = .023.

However no significant difference was found for the following three discussion outcomes when preparatory sessions were used: *promoted more thought about the topic under discussion*, (*Mdn* = 7 versus *Mdn* = 6), *U* = 377, z= -1.820, *p* = .069, *increased student awareness of differing perspectives* (*Mdn* = 7 versus *Mdn* = 5), *U* = 350, z = -1.648 *p* = .099, and *enhanced deeper levels of student thinking* (*Mdn* = 6 versus *Mdn* = 6), *U* = 358, z = -1.699, *p* = .089.

5.6 Implementing a discussion duration

Implementing a discussion duration means imposing a time limit for an AOD, rather than leaving an AOD open for an unlimited time. The most common AOD duration implemented in Study 1 was seven days reported by 26 instructors (32.9%), followed by 14 days reported by 12 instructors (15.2%). A minimum duration of one day was reported by three instructors with a maximum of 120 days reported by one instructor. Summary information for the discussion outcomes for those instructors who had implemented a set duration for an AOD compared to those instructors who had not is shown in Table 5-5.

Table 5-5: Comparison of AOD outcomes for those AOD that had implemented a discussion duration versus those that did not

AOD Outcomes	Discussion duration implemented			No discussion duration implemented		
	N	Mean	SD	N	Mean	SD
Promoted more thought about the topic under discussion	48	6.06	1.23	30	5.60	1.57
Increased student awareness of differing perspectives	47	5.98	1.34	28	5.32	1.50
Enhanced deeper levels of student thinking	48	5.73	1.32	29	5.10	1.54
Developed critical analysis and reflection in students	47	5.40	1.45	28	4.71	1.61
Improved student learning through the collaborative construction of knowledge	48	5.56	1.62	29	5.07	1.67
Improved student communication skills	44	5.30	1.49	27	5.00	1.69

To evaluate any differences in the perceived discussion outcomes between the AOD that implemented a set duration and those that did not, the nonparametric Mann-Whitney U test was used. Imposing a limit on the time available for an AOD was shown to have a significant positive impact on the achievement of three discussion outcomes: *increased student awareness of differing perspectives* (*Mdn* = 6 versus *Mdn* = 5), *U* = 471, z= -2.410, *p* = .032, *enhanced deeper levels of student thinking* (*Mdn* = 6 versus *Mdn* = 5), *U* = 510, z= -2.033, *p* = .042, and *developed critical analysis and reflection in students* (*Mdn* = 6 versus *Mdn* = 5), *U* = 479, z = -2.018, *p* = .044.

However, implementing a discussion duration had no impact on the achievement of the following discussion outcomes: *promoted more thought about the topic under discussion*, (*Mdn* = 6 versus *Mdn* = 6), *U* = 575, z= -1.582, *p* = .115, *improved student learning through the collaborative construction of knowledge* (*Mdn* = 6 versus *Mdn* = 5), *U* = 550, z= -1.585, *p* = .114 and *improved student communication skills* (*Mdn* = 6 versus *Mdn* = 5), *U* = 538, z= -0.686, *p* = .499.

5.7 Implementing a minimum number of required postings

Implementing a minimum number of required postings may help to motivate discussion participation but, on the other hand, may result in postings for the sake of meeting requirements. The numbers of instructors who had and had not implemented a minimum posting number are shown in Table 5-6, along with summary information for each of the discussion outcomes. When implementing a minimum number of required postings, the most frequently reported number for the minimum posting was 3 indicated by thirteen instructors (30.5%) followed by 2 postings reported by nine instructors (20.9%). A minimum of 1 posting was set by six instructors (14.0%), while one instructor reported having implemented a minimum of 15 required postings.

Table 5-6: Comparison of AOD outcomes for those AOD that had a minimum number of required postings implemented versus those that did not

	Minimum posting implemented			No minimum posting implemented		
AOD Outcomes	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Promoted more thought about the topic under discussion	43	6.14	1.13	35	5.57	1.61
Increased student awareness of differing perspectives	43	6.02	1.19	32	5.34	1.64
Enhanced deeper levels of student thinking	43	5.81	1.10	34	5.09	1.70
Developed critical analysis and reflection in students	43	5.58	1.20	32	4.56	1.76
Improved student learning through the collaborative construction of knowledge	43	5.74	1.40	34	4.91	1.83
Improved student communication skills	40	5.48	1.34	31	4.81	1.76

The nonparametric Mann-Whitney U was used to calculate the difference in the levels of discussion outcomes between those AOD with a minimum number of required postings and those without. Significantly higher ratings were reported in AOD that had implemented a minimum posting number for two of the discussion outcomes: *developed critical analysis and reflection in students* (*Mdn* = 6 versus *Mdn* = 5), $U = 444$, $z = -2.691$, $p = .007$, and *improved student learning through the collaborative construction of knowledge* (*Mdn* = 6 versus *Mdn* = 5), $U = 526$, $z = -2.169$, $p = .030$.

Implementing a minimum number of required postings had no impact on the four following discussion outcomes: *promoted more thought about the topic under discussion*, (*Mdn* = 6 versus *Mdn* = 6), *U* = 587, z= -1.766, *p* = .077, *increased student awareness of differing perspectives* (*Mdn* = 6 versus *Mdn* = 5.5), *U* = 518, z = -1.902, *p* < .057, *enhanced deeper levels of student thinking* (*Mdn* = 6 versus *Mdn* = 5), *U* = 552, z= -1.904, *p* = .057, and *improved student communication skills* (*Mdn* = 6 versus *Mdn* = 5), *U* = 491, z= -1.540, *p* = .124.

5.8 Using assessment

Instructors were asked whether any assessment had been used for the AOD, and if so, what had been assessed: an AOD contribution assessment[5] or a post-AOD assessment[6]. Data was also collected on the support given to students in the form of information about how the contributions would be graded and examples of graded contributions.

Fifty instructors (63.3%) had used assessment, with 38 (48.1%) of these using an AOD contribution assessment. Four instructors (5.1%) used a post-AOD submission for assessment and eight (10.1%) had used both the AOD contributions and a post-AOD submission for assessment. The most common format for the post-AOD submission was a reflective journal or report in which students were required to synthesise the information from the online discussion. One instructor reported that their post-AOD assessment consisted of a "self reflective report where the students

[5] An assessment that uses graded discussion contributions.
[6] An assessment that uses a piece of work submitted after the completion of the AOD.

had to nominate discussion postings that satisfied previously defined criteria and justify their choice"; another stated that he/she used an "assessment of the role of discussion in helping them understand the concepts"; a third instructor indicated that "student reflection on [the AOD] process informs their written submissions". Other comments indicated that the post-AOD submission was "part of a learning journal", a "project synthesising the posts", and "a reflective journal". Table 5-7 shows summary information for the discussion outcomes for AOD that used some form of assessment versus AOD that were not assessed in any way.

Table 5-7: Comparison of AOD outcomes for those AOD that were assessed versus those that were not

	Assessment used			No assessment used		
Discussion Outcomes	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Promoted more thought about the topic under discussion	50	6.28	0.97	28	5.18	1.72
Increased student awareness of differing perspectives	49	6.18	1.05	26	4.88	1.66
Enhanced deeper levels of student thinking	50	5.98	1.02	27	4.59	1.65
Developed critical analysis and reflection in students	49	5.65	1.15	26	4.19	1.74
Improved student learning through the collaborative construction of knowledge	50	5.78	1.33	27	4.63	1.93
Improved student communication skills	45	5.49	1.33	26	4.65	1.81

The nonparametric Mann-Whitney U test was used to determine if there were significant differences in instructors' perceptions of achievement of discussion

outcomes between those AOD that had used assessment and those that were not. The results showed significantly higher ratings when assessment was used for the following five discussion outcomes: *promoted more thought about the topic under discussion* (*Mdn* = 7 versus *Mdn* = 6), *U* = 403, z= -3.276, *p* = .001, *increased student awareness of differing perspectives* (*Mdn* = 6 versus *Mdn* = 5), *U* = 323, z= -3.657, *p* < .001, *enhanced deeper levels of student thinking* (*Mdn* = 6 versus *Mdn* = 5), *U* = 306, z= -4.090, *p* < .001, *developed critical analysis and reflection in students* (*Mdn* = 6 versus *Mdn* = 4.5), *U* = 313, z= -3.713, *p*<= .001, *improved student learning through the collaborative construction of knowledge* (*Mdn* = 6 versus *Mdn* = 5), *U* = 429, z= -2.708, *p* = .006. No significant difference was found for the discussion outcome of *improved student communication skills* (*Mdn* = 6 versus *Mdn* = 5), *U* = 437, z= -1.811, *p* = .070.

The importance of assessment in AOD in generating participation and improving the quality of postings was reflected in comments by various instructors: "without any assessment, there were only a small number of students who participated in the online discussion"; "highest motivator is compulsory assessed participation"; "I found that when the online discussion was not assessed, that input by students was very poor"; and "making it assessed increased the number and quality of postings". However, due to reported workload increases, some instructors were allocating marks for participation in a manner similar to that in which participation is marked in face-to-face classes, rather than assessing the quality of the AOD contributions. As one instructor stated, "I will not be assessing the quality of the posting…rather, the assessment will be similar to the points internal students receive for class participation…this way I get students to interact on a more regular basis, but also

keep my marking workload reasonable". Another instructor commented on the workload involved in assessing AOD contributions saying "I don't use online discussions as a form of assessment because I am concerned the workload...would be excessive".

The impact of assessment types was further examined by comparing different assessment approaches. In this examination, due to the low number of instructors (N = 4) that had used post-AOD assessment only, the post-AOD assessment approach was combined with the approach that used both post-AOD assessment and AOD contributions assessment. Therefore the following three assessment approaches were examined: AOD contribution assessment; post-AOD assessment with or without the use of graded AOD contributions, and lastly, no assessment. The nonparametric Kruskal-Wallis test was used to determine if there were any differences in the perceived discussion outcomes associated with these different assessment approaches. This test was used as an alternative to ANOVA to ensure that violations of the assumptions of ANOVA identified in preliminary assumption testing did not impact on the interpretation of the results. In cases where Kruskal-Wallis indicated significant differences, pairwise comparisons were performed using a Bonferroni correction for multiple comparisons (Dunn, 1964).

The Kruskal-Wallis test showed statistically significantly differences between the three assessment formats for all discussion outcomes: *promoted more thought about the topic under discussion* $\chi^2(2) = 14.70$, $p = .001$, *increased student awareness of differing perspectives discussion* $\chi^2(2) = 16.63$, $p < .001$, *enhanced deeper levels of student thinking* $\chi^2(2) = 23.32$, $p < .001$, *development of critical analysis and*

reflection $\chi^2(2) = 14.17$, p = .001, *improved student learning through the collaborative construction of knowledge* $\chi^2(2) = 11.68$, p = .003, and *improved student communication skills discussion* $\chi^2(2) = 6.07$, p = .048.

Post-hoc analysis (see Table 5-8) revealed a statistically significant difference between an AOD contribution assessment and an assessment of a post-AOD assessment with or without an AOD contribution assessment for the discussion outcome of *enhanced deeper levels of student thinking* only (*Mdn* = 6.0 versus *Mdn* = 7.0, *p* = .031). All other statistically significant differences in the post-hoc analysis were between the use of no assessment and any assessment, thus replicating the results achieved in the AOD Kruskal-Wallis test above. The lack of any other differences between the assessment approaches may be attributable to the low number of instructors (N = 12) who had used a post-AOD assessment. For detailed results of the post-hoc analysis see Appendix E.

Table 5-8: Comparisons of AOD outcomes for different assessment approaches

AOD outcomes		No assess-ment (N)	AOD contribution assessment (CA)	Post-AOD assessment with or without AOD contribution assessment (CA_PA+/-CA)	χ^2	Sign
Promoted more thought about the topic under discussion	N	28	38	12	14.70	.001 N_CA N_PA+/-CA
	Mean	5.18	6.13	6.75		
	SD	1.72	1.02	0.62		
	MR	28.89	42.05	56.17		
Increased student awareness of differing perspectives	N	26	37	12	16.36	<.001 N_CA N_PA+/-CA
	Mean	4.88	6.03	6.67		
	SD	1.66	1.12	0.65		
	MR	25.90	41.49	53.46		
Enhanced deeper levels of student thinking	N	27	38	12	23.32	< .001 N_CA N_PA+/-CA CA_PA+/-CA
	Mean	4.59	5.76	6.67		
	SD	1.65	1.05	0.49		
	MR	25.31	41.99	60.33		
Developed critical analysis and reflection in students	N	26	37	12	14.17	.001 N_CA N_PA+/-CA
	Mean	4.19	5.57	5.91		
	SD	1.74	1.26	0.67		
	MR	25.54	43.54	47.92		
Improved student learning through the collaborative construction of knowledge	N	27	38	12	11.68	.003 N_PA+/-CA
	Mean	4.63	5.55	6.50		
	SD	1.93	1.41	0.67		
	MR	29.87	40.33	55.33		
Improved student communication skills	N	26	34	11	6.07	.048 N_PA+/-CA
	Mean	4.65	5.29	6.09		
	SD	1.81	1.34	1.14		
	MR	30.31	36.44	48.09		

Note. MR = mean rank

N_CA Significant difference in means ($p<0.05$) between no assessment and an AOD contribution assessment

N_PA+/-CA Significant difference in means ($p<0.05$) between no assessment and a post-AOD assessment with or without an AOD contribution assessment

CA_PA+/-CA Significant difference in means ($p<0.05$) between an AOD contribution assessment and a post-AOD assessment with or without an AOD contribution assessment

Of the instructors who used an AOD contribution assessment, 41 (51.9%) provided information on how AOD contributions would be graded. Table 5-9 shows summary information about the discussion outcomes for those AOD that had received this information and those that did not.

Table 5-9: Comparison of AOD outcomes of AOD groups who received instruction about how contributions would be graded versus those who had not

	Received instruction			No instruction received		
AOD outcomes	**N**	**Mean**	**SD**	**N**	**Mean**	**SD**
Promoted more thought about the topic under discussion	41	6.17	1.14	37	5.57	1.57
Increased student awareness of differing perspectives	41	6.15	1.17	34	5.24	1.56
Enhanced deeper levels of student thinking	41	6.00	1.12	36	4.92	1.54
Developed critical analysis and reflection in students	41	5.68	1.17	34	4.50	1.70
Improved student learning through the collaborative construction of knowledge	41	5.80	1.47	36	4.89	1.72
Improved student communication skills	38	5.47	1.50	33	4.85	1.58

The nonparametric Mann-Whitney U test was used to determine if differences in instructors' perceptions of achievement of each of the discussion outcomes between AOD groups who had received information about how contributions will be graded and those who had not. Providing this information was shown to have a significant impact on the achievement of the following five discussion outcomes: *promoted*

more thought about the topic under discussion (*Mdn* = 6.0 versus *Mdn* = 7.0), *U* = 63, z= -2.077, *p* <= .038 *increased student awareness of differing perspectives* (*Mdn* = 5.0 versus *Mdn* = 7.0), *U* = 432, z= -2.952, *p* = .003, *enhanced deeper levels of student thinking* (*Mdn* = 5.0 versus *Mdn* = 6.0), *U* = 392, z= -3.663, *p* < .001, *developed critical analysis and reflection in students* (*Mdn* = 5.0 versus *Mdn* = 6.0), *U* = 390, z= --3.363, *p* = .001, and *improved student learning through the collaborative construction of knowledge* (*Mdn* = 5.0 versus *Mdn* = 6.0), *U* = 477, z = -2.747, *p* = .006. The discussion outcome of *improved student communication skills* (*Mdn* = 6.0 versus *Mdn* = 5.0), *U* = 469, z= -1.874, *p* = .061) did not show a significant difference when information on how contributions would be graded was given.

Providing examples of graded contributions was an uncommon practice with only six instructors (7.60%) having done so. No further analysis of this practice was therefore undertaken.

5.9 Using moderation

Instructors rated the contribution of moderation to AOD success relatively highly with a mean of 5.64 out of a maximum of seven (SD 1.56), with support for its importance reflected in instructors' comments: "the teacher role in designing for interaction and facilitating that interaction was critical" and to steer students away from irrelevant issues, "you need to take control of the discussion forum". Another comment favoured instructor moderation:

> My involvement in the discussion forum means that a different relationship…is built up with the students - more of a joint learning

> process. When the moderation of the forum has been undertaken by others the effect has not been the same.

Moderation may be performed by teaching staff, or by specific students. Alternatively, group self-moderation may be used where any of the discussion participants post moderation-type comments as they see fit without any one person being specifically responsible for doing so. As shown in Table 5-10, the instructors indicated that teaching staff were largely used for moderation; well over half of the instructors indicated that teaching staff performed the moderation related to the tasks of *rewording the original question when contributions are going off track* (57.0%), *posting comments to promote further discussion* (58.2%), and *censoring inappropriate postings* (53.2%), while over a third (36.7%) of instructors used teaching staff to *provide regular discussion summaries*. In contrast, use of student moderation was relatively uncommon; while ten instructors (12.7%) reported using students to *provide regular discussion summaries*, only three instructors (3.8%) used students for the three remaining moderation tasks.

Group self-moderation was used by 17 instructors (21.5%) for the task of *posting comments to promote further discussion*, and by 14 instructors (17.7%) to *censor inappropriate postings*. Eight instructors (10.1%) reported allowing group self-moderation for *rewording the original question when contributions are going off track*, while only four instructors (5.1%) used the group to *provide regular discussion summaries*.

Table 5-10 also shows the perceived ratings of success for each moderation task alongside those responsible for the moderation: teaching staff, students and group

self-moderation. The overall mean ratings, of how successful each kind of moderation was, were relatively high regardless of who performed the moderation. As so few instructors reported using student moderation, further statistical analysis between the moderation types was not viable.

Table 5-10: Comparisons of moderation success for each task as performed by teaching staff, nominated students and group self-moderation

Task	Responsibility	N	Minimum	Maximum	Mean	SD
Reword the original question when contributions are going off track	Instructor/tutor /teaching assistant	45	3	7	5.56	1.01
	Student	3	4	7	5.67	1.53
	Group self-moderation	8	3	7	5.50	1.31
Post additional comments to promote further discussion	Instructor/tutor /teaching assistant	46	2	7	5.28	1.01
	Student	3	6	7	6.33	0.58
	Group self-moderation	17	4	7	5.76	1.09
Provide regular discussion summaries	Instructor/tutor /teaching assistant	29	2	7	5.45	1.27
	Student	10	3	7	5.00	1.25
	Group self-moderation	4	4	7	6.00	1.41
Censor inappropriate postings	Instructor/tutor /teaching assistant	42	2	7	5.62	1.32
	Student	3	4	7	5.67	1.53
	Group self-moderation	14	5	7	6.50	0.65

Several instructors reported other ways of using moderation in online discussions. One instructor reported that his/her role in moderation was 'the guide on the side' providing feedback only on a group's summary of the clinical case being discussed online. It was additionally reported by this instructor that, having already held preparatory sessions on successful group work and instructing students to use Salmon's (2000) model to review their online development, further moderation intervention was unnecessary. Another instructor reported using a 'top' student to play the role of devil's advocate when the discussion failed to progress. Both of these instructors felt their respective methods of moderating were highly successful giving it the highest possible rating of seven.

5.10 Summary of results

Overall, instructors were positive in their comments about using AOD in their teaching. The majority of instructors reported using AOD for information sharing about any aspect of the course, while half of the instructors used the online space for the discussion of assigned topics.

Reasons given for discontinued use or non-use of AOD tended to revolve around the time-consuming and labour-intensive tasks of reading contributions and moderating the discussion. Lack of participation was another issue often resulting in assessment being used as a motivating factor to encourage contribution. However, the subsequent grading of these contributions was noted by some as being too time consuming. Given this, it was surprising that so few instructors had used a post-AOD submission for assessment as this may have alleviated some of the marking burden. Similarly, the burden of moderation may have been lessened by the use of student

performed moderation but such use was relatively uncommon, though many instructors allowed the forum members to perform moderation as they saw fit.

Table 5-11: Summary of significant influences on discussion outcomes found in Study 1

Discussion outcome	Factors					
	Providing the purpose for AOD	**Using prepara-tory sessions**	**Imple-menting an AOD duration**	**Implement-ing a minimum number of required postings**	**Use of assess-ment**	**How postings will be graded**
Promoted more thought about the topic under discussion	+				+	+
Increased student awareness of differing perspectives	+		+		+	+
Enhanced deeper levels of student thinking	+		+		+	+
Developed critical analysis and reflection in students	+	+	+	+	+	+
Improved student learning through the collaborative construction of	+	+		+	+	+
Improved student communication skills	+	+			+	

Note. + denotes a significant enhancement in the discussion outcome

A variety of factors that potentially influence discussion outcomes was investigated in the current study with instructors reporting having used them to various degrees. Table 5-11 provides an overview of the factors that were found to have enhanced

discussion outcomes. Providing the purpose for an AOD and using assessment in an AOD were the two factors that significantly influenced all discussion outcomes. At the same time, it can be seen that the discussion outcome associated with critical thinking was significantly influenced by all factors. Similarly, the outcome *improved student learning through the collaborative construction of knowledge* was influenced by all factors except that of AOD duration.

5.11 Overview

This chapter presented the results of the analysis of the data collected in Study 1. The chapter opened with descriptive information about the participants of the study and how they used AOD in their teaching. Many instructors had been using AOD for the past five years and were still exploring different ways of using it in their teaching. Instructors were generally positive in their comments about using AOD but were apprehensive about the time involved in both assessing the online postings and moderating the discussion.

Sections 5.4 - 5.9 presented the results of the analysis of the effect of factors influencing discussion outcomes as perceived by instructors who had used AOD for assigned topic discussion. It was shown that providing clear information about the purpose for an AOD enhanced all the discussion outcomes. The use of assessment, similarly, was shown to enhance all discussion outcomes. Instructors who had used a form of preparatory session at the commencement of the AOD reported positive impacts on the discussion outcomes associated with critical thinking, the collaborative construction of knowledge and with improving student communication skills. Implementing either a set discussion duration, or a minimum number of

required postings, was found to positively influence several different discussion outcomes.

The results of the current study also confirmed the important role of moderation in an AOD. It was found that teaching staff were largely responsible for moderation, and instructors reported that this type of moderation was relatively successful. Few instructors indicated allocating moderation duties to specific students, though many allowed the forum members to perform moderation as they saw fit.

The next chapter gives a detailed discussion of the results presented here and their implications. These results are revisited in the concluding chapter of this thesis, in the light of the results of Study 2.

Chapter 6
Study 1 Discussion

6.1 Introduction

The aim of the research described in this thesis is to investigate how student learning outcomes may be enhanced in a structured AOD. Study 1 was conducted to investigate the effect of a range of factors on the achievement of AOD outcomes. This chapter discusses the results of Study 1 which were reported in the previous chapter.

In Section 6.2, the findings related to each factor are presented and progress towards answering the associated research question, presented in Chapter 3, is discussed. This is followed by discussions of the implications of the research for future practice in Section 6.3, and unresolved issues for further research in Section 6.4. The limitations associated with Study 1 are presented in Section 6.5.

6.2 Research questions addressed

6.2.1 Effect of providing AOD purpose

All discussion outcomes targeted in Study 1 (see Table 6-1) were improved when the purpose for the AOD was provided. This finding is consistent with the results of other studies that have done similar research in this area. However, whereas Study 1 determined the achievement of discussion outcomes by using instructors' perceptions, other research has used student surveys (Dennen, 2005; Ellis et al., 2004; Roper, 2007) or a combination of student surveys and AOD transcript analysis

(Palmer & Holt, 2009). The use of instructor perceptions in Study 1 to assess levels of achievement in *developing critical analysis and reflection in students* substantiates the results of these previous studies but from an instructor point of view.

Table 6-1: Discussion outcomes positively influenced by providing the purpose for an AOD

Developed critical analysis and reflection in students
Improved student learning through the collaborative construction of knowledge
Improved student communication skills
Promoted more thought about the topic under discussion
Increased student awareness of differing perspectives
Enhanced deeper levels of student thinking

Given the literature's emphasis on the importance of providing the purpose for a learning activity (Al-Shalchi, 2009; Hew et al., 2010), it is surprising that only just over half of the instructors in Study 1 reported doing so. This omission could be related to the generally low levels of training and professional development in enhancing student learning outcomes in online discussion reported by the instructors in the current study.

In answering the research question:

RQ1.1: How does providing the purpose for an online discussion affect the achievement of AOD outcomes?

the empirical evidence from this study supports the findings of other studies, and shows the importance of providing the purpose for an AOD learning activity to student learning outcomes.

6.2.2 Effect of using preparatory sessions

The use of preparatory sessions significantly influenced the discussion outcomes associated with critical thinking, the collaborative construction of knowledge and student communication skills. The positive impact of using preparatory sessions on the discussion outcome of *developing critical analysis and reflection in students* is consistent with other research that has used some form of preparatory session prior to the commencement of an AOD. Both Alexander et al. (2010) and Bai (2009) reported more evidence of critical thinking in the AOD postings of students who had participated in preparatory sessions compared to those that did not have such instruction. The Study 1 finding is also consistent with suggestions that students do not automatically possess the skills needed in order to think critically and that instructional support about high order thinking would be beneficial (Christopher et al., 2004; Greenlaw & DeLoach, 2003; MacKnight, 2000).

However, the current study's finding is inconsistent with that of Duphorne and Gunawardena (2005), who reported no significant difference in student critical thinking when an advance organiser describing a critical thinking framework was used. The result achieved in their study may have been affected by the use of role assignment into the AOD at the same time as the advance organiser was introduced.

The positive influence of using preparatory sessions on *improving student learning through the collaborative construction of knowledge* is consistent with the results of an earlier study. Wozniak and Silveira (2004) compared the number of contributions that acknowledged previous contributions, compared to contributions that did not acknowledge previous contributions. The authors found significantly more contributions that referred to other contributions in the online discussion in which students had participated in preparatory sessions compared to the discussion in which students had not participated in preparatory sessions. It was concluded that the use of these preparatory sessions showed students how to use an AOD efficiently for more effective student-to-student interaction resulting in higher levels in knowledge construction.

The influence of preparatory sessions on student communication skills does not appear to have been reported upon in the literature. The fact that preparatory sessions had a significant impact on the outcome of *improving student communication skills* possibly suggests that these sessions raise student awareness of their communication ability and show the connection of communication skills to both critical thought (Cohen & Spencer, 1993) and the collaborative construction of knowledge (Applebee, 1984; MacKnight, 2000). Communication skills are necessary prerequisites for the analysis and reflection involved in critical thought and for creating knowledge in a socially collaborative manner. Hence instruction focusing on critical thought can be expected to have spill over effects on communication skills and the collaborative construction of knowledge.

Preparatory sessions did not impact the discussion outcomes associated with low order thinking (*promoted more thought about the topic under discussion*) or the two discussion outcomes associated with middle order thinking (*increased student awareness of differing perspectives*, and *enhanced deeper levels of student thinking*). This finding may suggest that students already have adequate knowledge of the skills associated with these outcomes with further instruction being unnecessary. Another explanation may be that as these levels in thinking have been reported to be largely successfully achieved in AOD (Angeli et al., 2003; Bradley et al., 2008; Darabi et al., 2011; Fahy, 2005; McLoughlin & Mynard, 2009; Szabo & Schwartz, 2011), perhaps the impact of preparatory sessions on these outcomes was not recognised by the participants in the study. A third possibility for the lack of influence on these outcomes may be the absence of interactivity, generally considered more effective than purely providing information, in the preparatory sessions reported on in Study 1. Only five of the 17 instructors indicated that their sessions were hands-on practice instruction employing interaction. Providing information alone on thinking skills or collaborative learning does not guarantee that students understand these concepts or know how to apply them (Greenlaw & DeLoach, 2003; MacKnight, 2000). Further research is needed to investigate exactly what should be included in these preparatory sessions and how they should be conducted.

In answering the research question:

RQ1.2: How do preparatory sessions given to students at the commencement of an online discussion affect the achievement of the AOD outcomes?

the findings of Study 1 provided empirical evidence that teaching students about critical thinking and the collaborative construction of knowledge prior to the

commencement of an AOD may result in enhanced discussion outcomes. These findings are particularly pertinent, as discussion outcomes related to critical thinking and the social construction of knowledge are two of the most frequently strived for learning outcomes in the AOD environment.

6.2.3 Effect of implementing an AOD duration

The AOD protocol of implementing of a set duration for an AOD was found to have a positive impact on the high order thinking outcome of *developed critical analysis and reflection*, and the two outcomes associated with middle order thinking skills (*increased student awareness of differing perspectives*, and *enhanced deeper levels of student thinking*).

The finding that a set AOD duration had an influence on high order thinking skills is an important result as little has been reported about the direct effect of duration on these thinking outcomes (Hew & Cheung, 2011). The finding also gives some support to the suggestion that having a set duration for an AOD may help clarify expectations for students so that they can spread their efforts over the allotted time (Dennen, 2005).

Another aspect that needs to be considered when implementing a set time for an AOD is finding the optimal balance between an adequate time for interaction and reflection with that of information overload from reading lengthy contributions (Gilbert & Dabbagh, 2005; Hara et al., 2000). The findings of Study 1 showed that almost half of the AOD were limited to either 7 or 14 days; this result is consistent with other research.

However, no significant difference was found in *the collaborative construction of knowledge* outcome when AOD duration was implemented. This lack of impact is consistent with the findings of Hew and Cheung (2011) who reported no correlation between the duration of an AOD and the number of high level knowledge construction occurrences in the AOD.

Similarly the implementation of a set AOD duration was found to have no significant impact on the outcomes associated with student communication skills or low order thinking (*promoted more thought about the topic under discussion*). It may be reasonable to conclude that a set duration is irrelevant in the development of student communication skills, while low order thinking and sharing information happens in an AOD regardless of discussion duration.

In answering the following research question:

RQ1.3: How does the implementation of a set duration for an online discussion affect the achievement of AOD outcomes?

the findings of Study 1 provided evidence that a set duration is an important factor for promoting high order thinking, but does not appear to affect the discussion outcomes of collaborative construction of knowledge and student communication skills. These findings, however, provide a useful starting point for further research investigating an optimal time for the AOD duration.

6.2.4 Effect of implementing a minimum number of required postings

The findings of Study 1 showed that implementing a minimum number of required postings had a positive influence on the discussion outcomes associated with critical

analysis and reflection, and the collaborative construction of knowledge. In Study 1 three postings was most frequently reported as the minimum number of required postings. This result is consistent with that of Biesenbach-Lucas (2004) who suggested that a minimum of three required postings per semester is optimal for the promotion of collaborative learning in AOD. The finding also supports literature suggestions that having a minimum posting number as part of the AOD requirements helps to clarify what is expected of students, thus enhancing learning outcomes (Gilbert & Dabbagh, 2005; Hew & Cheung, 2011).

However, in contrast to the finding above, Murphy and Coleman (2004) reported that the postgraduate students in their study opposed the implementation of a number of required postings because they believed it turned the AOD into another opportunity to grab assessment points and detracted from actual learning. These students appeared highly motivated and looked upon the AOD as a learning experience where information is shared and exchanged and actual learning takes place. Likewise Hara et al. (2000), whose study consisted of master and doctoral students in whom a similar outlook about AOD might be expected, reported that a minimum posting requirement did little to encourage committed and engaged participation. Perhaps this protocol is less required in postgraduate AOD; however, the findings of Study 1 suggest that its inclusion was important both for undergraduate and postgraduate students.

The implementation of a minimum number of required postings did not significantly influence the discussion outcomes associated with low to middle order thinking nor that of improving student communication skills. As suggested in Section 6.2.2, the

lack of influence on these thinking outcomes may be because students are already exhibiting competence in the use of low to middle order thinking.

In answering the following research question:

RQ1.4: How does the stipulation of a minimum number of required postings in an online discussion affect the achievement of AOD outcomes?

the findings of Study 1 provided empirical evidence that implementing a minimum number of required posting is of value for discussion outcomes associated with critical thinking and the collaborative construction of knowledge.

6.2.5 Effect of using assessment

The findings of Study 1 showed that the use of assessment in an AOD had a positive impact on all discussion outcomes and was often used by instructors to ensure participation. This result is consistent with literature where it is claimed that, without some form of assessment, students will neither visit nor participate in an AOD, and that assessment is necessary to motivate students to take extra care in creating their discussion contributions (Hara et al., 2000; McKenzie & Murphy, 2000; Palmer & Holt, 2009; Rovai, 2003; Williams, 2002). This reinforces the role of assessment both for motivating student participation in an AOD and, more importantly, in contributing towards the development of student learning in this environment.

Though the results of the current study favoured the use of assessment in AOD, there is some opposition to its use in AOD. O'Reilly and Newton (2001) reported that students in their study had an intrinsic motivation to participate in an AOD making assessment unnecessary. The participants in their study were largely mature age

students who reported the value of AOD interaction for engaging in mutual support with peers and overcoming the isolation associated with exclusively online courses. This may be the ideal situation but is probably atypical of many students.

The fact that all discussion outcomes associated with developing student thinking (Table 6-2) were enhanced by the use of assessment substantiates reports that online discussion is a highly suitable medium for facilitating thought and, when combined with assessment, results in more careful reading of peer postings and awareness of the opinions expressed therein (Dennen, 2008a; Newman et al., 1995; Vonderwell et al., 2007; Williams, 2002). Assessment thus appears to encourage more involvement in the discussion which in turn fosters deep thinking in students.

Table 6-2: AOD outcomes associated with thinking skills

Developed critical analysis and reflection in students
Promoted more thought about the topic under discussion
Increased student awareness of differing perspectives
Enhanced deeper levels of student thinking

The discussion outcome of *improving student learning through the collaborative construction of knowledge* was also significantly influenced by the use of assessment. This result is consistent with similar studies that have reported on the role of AOD in supporting collaborative knowledge construction; however, collaborative activity does not happen automatically or spontaneously. Much research stresses the need for student support, instructor intervention and thoughtful structuring and integration within the subject matter in order to facilitate

collaborative learning (Biesenbach-Lucas, 2004; Curtis & Lawson, 2001; Lambert, 2003 ; Lee, 2003; Schellens & Valcke, 2006; Sringham & Geer, 2000; Taradi & Taradi, 2004; Weasenforth, Biesenbach-Lucas, & Maloni, 2002).

The use of assessment enhanced student communication skills; a result that is consistent with what has been proposed in the literature (Applebee, 1984). The result also suggests that students take more care in articulating their contribution when they are being assessed as suggested by Dennen (2008a) and Garrison et al. (1999)

In answering the assessment related research question:

RQ1.5: How does the use of assessment in an online discussion affect the achievement of AOD outcomes?

the findings of Study 1 provided empirical evidence that the use of assessment has a positive impact on all discussion outcomes. When using assessment in an AOD, the discussion contributions are usually assessed. In Study 1, over one third of the participants did not use any form of assessment. This substantiates suggestions in the literature that assessment frameworks that are not hugely time consuming are needed, as the ones currently available do not appear to be extensively used (Dennen, 2008a; McKenzie & Murphy, 2000). As a result, it has been suggested that a post-AOD assessment may be a better choice both for student learning (Arend, 2009; Dennen, 2008a; Richardson & Ice, 2010) as well as easing the marking burden associated with grading AOD postings (Brookhart, 2004; DiBiase, 2004; Lazarus, 2003).

The findings of Study 1 showed some potential in the use of an assessment approach that combines an AOD contribution assessment with a post-AOD assessment. This combined assessment approach had a positive impact on the discussion outcome associated with middle order thinking (*enhanced deeper levels of student thinking*) when compared to the assessment of AOD contributions only. However, there was no further evidence to encourage the use of such a combined assessment approach. Furthermore, given the burden of marking AOD contributions it is unlikely that adding a post-AOD submission would be feasible or advisable.

Unfortunately the findings of Study 1 were inconclusive regarding use of a post-AOD assessment only, owing to the low adoption of this approach. More research is needed to ascertain the viability of using a post-AOD submission for assessment, or possibly the use of a post-AOD submission together with a simplified form of an AOD contribution assessment.

In answering the assessment related research question:

RQ1.6: How does having a post-AOD assessment based on the online discussion affect the achievement of AOD outcomes?

the findings of Study 1 provided some tentative evidence suggesting the usefulness of a post-AOD submission for assessment, but were inconclusive about the use of such an assessment alone. Further research is needed in this area.

The inclusion of an assessment rubric was shown to have a positive impact on all discussion outcomes except for that of *improving student communication skills*; an unexpected result. Enhancing student communication skills is a widespread learning

outcome for almost all courses and disciplines, and is a desirable outcome for many assessment activities. As a result, assessment rubrics often list improving communication skills, but this goal may make little impact on student consciousness because they are more focused on the direct subject-oriented aims of the learning activity. A more beneficial approach may be to include exemplars of well-expressed language (Penny & Murphy, 2009; Solan & Linardopoulos, 2011). As assessment rubrics were not commonly used in Study 1, further research could usefully investigate the impact of their inclusion.

In answering the assessment related research question:

RQ1.7: How does providing an assessment rubric for an online discussion affect the achievement of AOD outcomes?

the findings of Study 1 provided empirical evidence that an assessment rubric had a positive impact on all discussion outcomes, except that associated with communication skills.

6.2.6 Effect of moderation

The findings of Study 1 showed that moderation plays a very important role in an AOD and that teaching staff were performing the majority of this moderation. This is consistent with results of similar studies in which it was reported that instructor moderation was the major contributor in promoting coherent and interactive dialogue necessary for achieving high levels in discussion learning outcomes (Garrison et al., 1999; Shea et al., 2006; Thomas, 2002).

In contrast to this result, Mandernach et al. (2009) reported improved levels in the display of high order thinking skills in an AOD with a relatively inactive instructor compared to one who was actively moderating. However, it has also been shown that the type of instructor moderation may be more relevant than the amount of instructor intervention (Arend, 2009; Dennen, 2005).

The findings of Study 1 showed that student moderation was sparsely used. This is a surprising result as several studies had reported that student moderation resulted in improved levels in learning outcomes (LaPointe & Gunawarndena, 2004; Leh, 2002; Rourke & Anderson, 2002). The use of students to moderate an AOD advances the constructivist principles upon which AOD was based thus fostering a student-centred approach to learning (Rourke & Anderson, 2002; Seo, 2007). Perhaps further research may examine why students are so rarely used to perform the tasks associated with moderation.

Additionally, it was found in the current study that teaching staff were spending up to five hours in any week on discussion moderation. Concerns about the time consuming nature of moderation have been raised in the literature (Cranney, Wallace, Alexander, & Alfano, 2011; Lazarus, 2003; Mandernach, Dailey-Hebert, & Donnelli-Sallee, 2007; Rourke & Anderson, 2002; Shi, Bonk, & Magjuka, 2006) and the use of students to perform at least part of the moderation may help to alleviate this burden for teaching staff. It seems that the use of students for moderation is a pedagogically and practically sound solution. Perhaps further research may examine why students are so rarely used to perform the tasks associated with moderation.

When student moderation was used, albeit sparingly, the results of Study 1 showed students were primarily performing the task of creating summaries of the discussion. This is a very apt task for students as it calls for synthesising the information in the forum, a skill strongly associated with high order thinking. Schellens and Valcke (2005) reported that, among a number of tasks assigned to students during an AOD, the task of providing summaries of the discussion resulted in the highest levels of knowledge construction.

The low level of student moderation reported in Study 1 was possibly reflected in the use of group self-moderation (whereby the discussion members are free to post comments as they see fit) as the default moderation form when teaching staff were not involved. This practice may not be pedagogically optimal as more interaction and in-depth engagement has been found in student moderated forums compared to those in which no moderation was implemented (Seo, 2007).

In answering the research question:

RQ1.8: How does the person performing the different moderation tasks affect the achievement of the AOD outcomes?

the findings from Study 1 show that teaching staff were effective moderators in an AOD. The lack of student moderation reported in Study 1 prevents any firm conclusions as to its efficacy but research reported subsequent to the data collection in Study 1 has provided evidence in favour of student moderated AOD (Nandi, Hamilton, & Harland, 2012; Wise, Saghafian, & Padmanabhan, 2012; Xie et al., 2014). For the moderation task of providing summaries of the AOD, the findings of the current study tentatively indicated that this appears to be a particularly useful task

for students to perform; a result that has been supported in other research (Hew & Cheung, 2008, 2010; Schellens et al., 2005; Wang, 2008).

6.3 Implications for practice

The findings from Study 1 provide some insight into what educators can do to enhance student learning outcomes in AOD, and have a number of important implications for future practice. Overall, the participants of the current study were embracing the use of AOD in their teaching and were actively investigating ways to improve student learning in this discussion environment. The results of Study 1 showed that a range of factors have a significant impact on a range of discussion outcomes. Furthermore, the results showed that providing students with the purpose for the AOD and incorporating assessment with the AOD significantly influenced all discussion outcomes. This range of influential factors gives educators a variety of approaches that may be employed when creating and conducting an AOD.

The findings of Study 1 reinforce previous research suggestions that student learning does not happen spontaneously in an AOD but requires support and scaffolding. Students need to understand why they are being asked to participate in a learning activity that calls for a considerable investment of their time and effort. They also need to be intrinsically motivated apart from any external reward such as the achievement of marks. The findings of Study 1 add to the knowledge base by highlighting two important types of support: the provision of clearly stated discussion purpose; and the use of preparatory sessions. Educators should include both of these factors when creating an AOD to enhance levels in both high order thinking and socially constructed knowledge. However, providing information alone

does not guarantee student understanding (Greenlaw & DeLoach, 2003; MacKnight, 2000) and so educators should create practical interactive instruction that calls for student involvement (Thomas, 2013).

The use of assessment in AOD has been shown to encourage participation in the AOD, though the use of such an extrinsic reward is far from ideal (Beebe et al., 2010; Gulati, 2008). The findings of Study 1 suggest that educators should adopt assessment in their AOD, and that the inclusion of an assessment rubric could be a very useful strategy. In order to overcome the time consuming task of marking of AOD contribution, alternative forms of assessment are needed. The use of a post-AOD submission for assessment seems like a practical alternative, but the results of the current study were inconclusive about this assessment approach.

Though there is little debate about the necessity of protocols to govern AOD, there is uncertainty about which rules and deadlines are most suited to achieving particular discussion outcomes. In Study 1, setting a fixed discussion duration did not influence the collaborative construction of knowledge. However as Chai and Khine (2006) suggest that an extended time period is often needed to improve levels in the collaborative construction of knowledge, perhaps educators should have a semester-long AOD when seeking this discussion outcome.

The performance of moderation by teaching staff has important benefits for student learning. However, additional benefits may be derived if students are more involved in the moderation (LaPointe & Gunawarndena, 2004; Rourke & Anderson, 2002; Schellens et al., 2005). In relation of the use of student moderation, the results from

Study 1 were inconclusive; however, research in recent years has provided insight into this issue. Some of this research includes investigating the differences in the behaviour of students both as moderators and participants in an AOD (Xie, 2013; Xie et al., 2014), the effects of role assignment for students moderating an AOD (Wise, Saghafian, et al., 2012) as well as finding ways to facilitate a student-centred learning approach in an AOD using moderation (Nandi et al., 2012). This research is providing much needed guidance for optimal learning benefit using moderation in the AOD environment.

The development of high order thinking and the social construction of knowledge are the most sought after learning outcomes in AOD. Concern echoed in the literature centres around the failure to move student performance beyond the low levels of these skills currently being displayed in AOD (Garrison & Arbaugh, 2007; Maurino, 2007). The findings of Study 1 have contributed to the knowledge base by highlighting several factors that may be adopted to help alleviate this situation with student learning in the AOD environment.

6.4 Outstanding issues

The findings of Study 1 have identified several areas in need of further investigation. The findings of Study 1 suggest that there are very clear benefits in using assessment in AOD and so a form of assessment should be employed both to enhance learning and encourage participation. However, in order to maximise the benefits of assessment, an effective and time efficient method is needed, especially for large undergraduate courses where assessing the discussion contributions is too burdensome (Andresen, 2009). The suggestion of using a post-AOD submission

assessment appears promising both for easing the marking burden and as an indicator of learning. However, the findings of Study 1 were inconclusive regarding the use of such an assessment approach, and further research is needed in this area.

AOD protocols are needed to clarify expectations and requirements; however, it is not entirely clear which rules and deadlines are needed in an AOD. The discussion outcome associated with the collaborative construction of knowledge was not influenced by implementing a fixed discussion duration, but specifying a minimum number of required postings was found to have a significant impact on the outcome. Gilbert and Dabbagh (2005) suggested that, in addition to specifying a minimum number of required postings, students should be required to spread these postings over a certain number of days. More research is needed here.

Finally, the discussion outcome related to critical thinking was significantly influenced by all of the factors targeted in Study 1. This result confirms the importance of this outcome, and any benefits derived from the enhancement of student high order thinking will have spill over effects to the related outcome of the social construction of knowledge and in the process of such reading and writing student communication skills should improve. Therefore, future research should be primarily focused towards this discussion outcome.

6.5 Limitations of Study 1

This study has a number of limitations that may affect the interpretation of the results. Firstly, as participants were recruited on a voluntary basis via a number of educational and information systems electronic mailing lists, it would be reasonable

to conclude that those instructors who volunteered to participate in Study 1 may represent the enthusiasts for AOD rather than instructors in general (Atkinson, 2007; Carbonaro, Bainbridge, & Wolodko, 2002). The results could, therefore, be a reflection of the experience of these kinds of instructors rather than a representation of all instructors.

A second limitation relates to the time and effort involved in assessing AOD. It is possible that instructors who assess the AOD may rate the achievement of the discussion outcomes more highly than those not assessing the discussion contributions due to the time and effort investment. Measurement of actual rather than perceived impacts of assessment of AOD on students' learning outcomes in future research would clarify this issue. Furthermore, as instructors' perceptions were collected for this study, a similar conclusion may be drawn for those instructors using preparatory sessions, with those who had invested considerable time in creating and conducting the sessions possibly reporting favourable outcomes. Further research could measure the actual achievement of outcomes and compare the findings with the results of the current study.

Finally, the majority of instructors were from English speaking backgrounds, with a marked absence of representation from Asian/African and Middle Eastern cultures. Instructors not represented in the study may have different perceptions of learning in AOD. Similarly, students from cultural backgrounds not represented in Study 1 may require different forms of support in AOD (Hew et al., 2010). Thus the results from the current study are particularly applicable to teaching in English speaking backgrounds and this may potentially limit the transferability of the findings.

6.6 Overview

This chapter presented the discussion of the results of Study 1. The study has explored a number of factors potentially influencing the achievement of AOD outcomes associated with thinking skills, the collaborative construction of knowledge and communication skills. Specifically, this study was motivated by concerns expressed in the literature about the failure to move student learning, in an AOD, beyond the basic low skill levels currently being reported to those levels representing high order thinking and knowledge construction (Akyol & Garrison, 2011; Gao et al., 2013; Maurino, 2007).

This study has contributed to the research in AOD by highlighting the importance of two factors that have not received much attention in previous studies. Providing the purpose for the AOD and the provision of preparatory sessions were shown to have a significant influence on several major discussion outcomes. The study also found that the use of assessment had a positive significant influence on all discussion outcomes. The fact that all factors had a positive impact on the AOD outcome associated with critical thinking was also discussed.

As a result of the findings of the study, several suggestions were made for educators seeking to enhance discussion outcomes, especially those outcomes associated with high order thinking. In addition, several opportunities for further research were identified. The inclusion of assessment was shown to be necessary in AOD, but the results were inconclusive regarding the use of a post-AOD assessment. As such an assessment approach holds much promise from both a practical and pedagogical standpoint, further research into post-AOD assessments is highly warranted. This

area is the subject of the research for the second study described in this thesis. The following chapter presents the rationale for the research conducted in Study 2.

Chapter 7
Study 2 Research Questions

7.1 Introduction

This thesis is concerned with enhancing student learning outcomes in AOD. Study 1 was an exploratory survey which investigated the impact of a number of factors on AOD outcomes as perceived by instructors. The research conducted in Study 1 identified several factors of significance relating to discussion outcomes and highlighted areas requiring further research. Study 2 was designed to follow up on the unresolved issues relating to assessment raised in Study 1.

This is the first of four chapters that describe Study 2, with this chapter presenting the research questions in the context of previous research. Chapter 8 describes the methodology used for this study, while Chapter 9 presents the results. Finally, Chapter 10 discusses these results.

7.2 Research questions and hypotheses

The objective of the research described in this thesis was to investigate how student learning outcomes may be enhanced in AOD. The overarching research question for the thesis is:

> *How can student learning outcomes be enhanced in an asynchronous online discussion (AOD)?*

The research conducted in Study 1 identified several factors of significance relating to discussion outcomes, however not all of the outstanding issues could be addressed

in one follow-up study. Providing the purpose for the AOD and the use of assessment both significantly influenced all discussion outcomes, however the findings regarding the use of assessment were not entirely clear, thus inviting further investigation.

The research in Study 1 found that assessment played an important role in AOD success. As was discussed in Chapter 6, the use of assessment in AOD positively affected all discussion outcomes, a result consistent with suggestions in the literature (MacKinnon, 2000; McKenzie & Murphy, 2000; Ng & Murphy, 2005). The results of Study 1 reinforced the importance of assessment in AOD; however, the question of what should be assessed in AOD remains. The use of a post-AOD assessment[7] was investigated in Study 1 but the results were inconclusive. However, the use of an alternative assessment still warrants further investigation, and Study 2 was therefore designed to explore the role of assessment further, by investigating different assessment approaches.

The research described in Study 1 investigated a number of AOD outcomes: those relating to student thinking skills, ranging from low order to high order thinking; the social construction of knowledge; and communication skills. The outcome related to critical thinking (*developed critical analysis and reflection in students)* was found to be influenced by all of the factors examined in Study 1, indicating the large potential for critical thinking skills to be enhanced by improvements in AOD design. The priority given to the achievement of critical thinking in many tertiary institutions

[7] An assessment that uses a piece of work submitted after the completion of the AOD.

further supports its importance (Abrami et al., 2008; Barrie, 2007; Pithers & Soden, 2000). Furthermore, concern has been expressed about a lack of understanding of critical thinking concepts amongst students (Cheong & Cheung, 2008). Given these reasons, Study 2 was designed to focus solely on critical thinking outcomes in AOD.

Davies (2011) has expressed concern about the inadequate levels in critical thinking skills possessed by graduates upon leaving tertiary education. This view is echoed by other studies that suggest undergraduate students achieve minimal improvement in their critical thinking over the duration of their undergraduate degrees (Barrie, 2005; Carrington et al., 2011; Kirkpatrick & Mulligan, 2002; Vandermensbrugghe, 2004). This concern, about inadequate levels in student critical thinking skills, is reflected in AOD literature (Cheong & Cheung, 2008; Christopher et al., 2004; Greenlaw & DeLoach, 2003).

Earlier in this thesis (see Section 2.3), high order thinking operations were defined as consisting of analysing, synthesizing and evaluating. Critical thinking and high order thinking were considered identical, with the terms being used interchangeably for the research described in this thesis. For the purpose of Study 2 critical thinking is defined as ‘the intellectually disciplined process of actively and skilfully, applying, analysing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action’ (Scriven & Paul, 1987).

Given the results of Study 1 regarding assessment and the importance of critical thinking outcomes in higher education, Study 2 was designed to address the following research question:

RQ2: How can the use of assessment enhance student critical thinking in asynchronous online discussion (AOD)?

Two secondary research questions were considered for Study 2, the first of which has three hypotheses. These are discussed in Sections 7.2.1 and 7.2.2 below.

7.2.1 Assessments in AOD

AOD has the potential to enhance critical thinking in students. The delayed nature of communication in an AOD allows time for reflection, while its text-based nature enables the combination of thinking and writing so necessary for the facilitation of critical thinking (Foley & Schuck, 1998; Greenlaw & DeLoach, 2003; Hara et al., 2000).

Research shows there is a strong relationship between the acts of critical thinking and writing (Althaus, 1997; Applebee, 1984; Cohen & Spencer, 1993; Cook, 2002; Tierney, Sorter, O'Flahavan, & McGinley, 1989; White, 1993). Applebee (1984) states that "it is widely accepted that good writing and careful thinking go hand in hand" (p. 577) and that one is not possible without the other. Similarly, Cohen and Spencer (1993) reported that after the introduction of writing and reading exercises specifically designed to teach argument, student levels of critical thinking improved dramatically.

In an AOD students need to create their discussion in a written form and read their peers' postings. This written form of discussion exposes students to diverse viewpoints, requiring them to evaluate material from multiple perspectives, make judgements about the material presented and finally, synthesise and draw inferences before coming to their own conclusions (Birch & Volkov, 2007; Rodrigues, 1999; Schellens & Valcke, 2006; Wu & Hiltz, 2004). While there is strong support for the idea that the act of participating in an AOD facilitates critical thinking, there is debate about where evidence of critical thinking may be found (Arend, 2009; Baskerville, 1999; Dennen, 2008a; Richardson & Ice, 2010). It has been suggested that although an AOD helps with the development of critical thinking, the contributions of an AOD may not be the place to find evidence of critical thinking. Garrison et al. (2001) identified the activities happening in an online discussion as representing the process of learning rather than any outcome of critical thinking. So when introducing assessment into an AOD, using an AOD contribution assessment[8] may not be the optimal approach as evidence of critical thinking may be found elsewhere, and a different assessment approach could be needed (Richardson & Ice, 2010). The research described in Study 2 examined the effect of different assessment approaches on student critical thinking by seeking to answer the following research question:

RQ 2.1: How do different forms of assessment used in an AOD affect student critical thinking skills?

[8] An assessment that uses graded discussion contributions.

The most common assessment approach used in AOD is reported to be an AOD contribution assessment (Dennen, 2008a). Consistent with this, 46 of the 50 instructors in Study 1 who assessed their AOD reported using an AOD contribution assessment. Given this general practice of assessing the contributions, Study 2 incorporated this form of assessment to provide the basis for comparison with an alternative assessment approach.

In Study 1, assessment in AOD was examined from the instructor perspective. To give a complete picture of the effect of assessment on discussion outcomes, and complement the findings of Study 1, the research described in Study 2 sought to capture student perspectives of the effect of assessment on critical thinking skills. Given the findings of Study 1, it was hypothesised that:

H 2.1: Students will perceive an improvement in their critical thinking skills after participating in an online discussion with an AOD contribution assessment.

In Section 2.5.4, where assessment in AOD was reviewed, it was suggested that using a culminating activity based on the online discussion may be a more effective assessment strategy than having AOD contributions graded (Dennen, 2008a; Greenlaw & DeLoach, 2003). Students may need another step requiring them to engage with the discussion material in order to fully stimulate their critical thinking, and show evidence of the final stages of critical thinking (Akyol & Garrison, 2011; Richardson & Ice, 2010). The use of a post-AOD assessment may provide this step, giving students the opportunity for reflection on, and analysis of, the discussion contributions, while deciding what to include from this material into the post-AOD

assessment (Arend, 2009). This extra step calling for evaluation and judgement skills may potentially stimulate student thinking to a further degree than does the act of participating in a discussion alone (Hazari, 2004; Vonderwell et al., 2007). The research in Study 2 was therefore designed to investigate the use of a post-AOD assessment, and its effect on student critical thinking. It was hypothesised that:

H 2.2 Students will perceive an improvement in their critical thinking skills after participating in an online discussion with a post-AOD assessment.

Study 1 examined several assessment approaches: AOD contribution assessment; post-AOD assessment; both graded AOD contributions together with a post-AOD submission for assessment; and no assessment. The results showed that, for the study sample, the highest levels in the discussion outcomes were reported by those instructors who used graded AOD contributions together with a post-AOD submission for assessment. The next highest levels were from those who had used a post-AOD assessment, while those who had used an AOD contribution assessment reported the lowest levels of everyone who had used assessment. However, as only twelve instructors had used a post-AOD assessment the differences were not significant, but do suggest that a post-AOD assessment may have some merit.

The research in Study 2 was therefore also designed to compare two different assessment approaches: an AOD contribution assessment, and a post-AOD assessment. It was hypothesised that:

H 2.3: Critical thinking skills will be more evident in students who complete a post-AOD assessment than in students who complete an AOD contribution assessment.

7.2.2 Student awareness of critical thinking

As was discussed in Section 2.4.1, AOD research relating to critical thinking has focused in several areas: improving levels of student critical thinking (Alexander et al., 2010; Darabi et al., 2011; Garrison et al., 2001; Gilbert & Dabbagh, 2005; Golding, 2011; Kalelioglu & Gulbahar, 2014; Ng et al., 2012; Pena & Almaguer, 2012; Richardson & Ice, 2010); evaluating critical thinking skills (Bradley et al., 2008; Garrison et al., 2001; Hara et al., 2000; Kay, 2006; Newman et al., 1995; So & Brush, 2008; Szabo & Schwartz, 2011); and investigating student satisfaction with online discussion and what they perceive would enhance their learning in an AOD (An et al., 2009; De Leng et al., 2009; Goodfellow & Lea, 2005; Kim, Liu, & Bonk, 2005; Swan, 2001).

All of this research has made a huge contribution to our knowledge about critical thinking learning in the AOD environment. However, for learning to be effective, a learner should be able to assess their own abilities accurately, and recognise critical thinking in themselves and others. It has been suggested that higher levels in critical thinking outcomes are displayed in an AOD when students are aware of critical thinking concepts, and know how to apply these concepts to their own thinking (Bai, 2009; Gilbert & Dabbagh, 2005; Schellens et al., 2009). However, these studies have not provided much insight into student awareness of critical thinking, nor how students perceive the development of their own thinking skills. Hamann et al. (2012) used student perceptions of their own critical thinking development to assess the effect of differently designed AOD, but this provided little insight into what constituted critical thinking for these students.

Outside of the AOD domain, several studies have provided insight into student awareness of critical thinking concepts and skills, highlighting where knowledge and skills are lacking, so that the appropriate measures can be applied (Hammer & Green, 2011; Hofreiter, Monroe, & Stein, 2007; Mummery & Morton-Allen, 2009; Phillips & Bond, 2004; Tapper 2004). Hammer and Green (2011) found students were lacking in critical thinking associated reading skills, and Hofreiter et al. (2007) found students struggled with the role of emotion in critical thinking, while the studies by Mummery and Morton-Allen (2009) and Tapper (2004) looked at student perceptions regarding their development as critical thinkers.

Similar insight is needed about students participating in the AOD environment, as without such information it can be difficult for instructors to be sure students are grasping the concepts involved in thinking critically. Additionally, it has been suggested that perhaps a lack of critical thinking knowledge is partly responsible for the low levels of these high order skills reported in AOD literature (Cheong & Cheung, 2008).

Therefore, research is needed that investigates student critical thinking knowledge and development. The research conducted in Study 2 was designed to address this issue of student awareness of critical thinking, and sought to answer the following research question:

RQ2.2: What is student awareness of critical thinking concepts and skills after participating in an assessed AOD?

7.3 Overview

This chapter is the first of four chapters describing the second study undertaken in the research described in this thesis. This chapter presented the research questions and associated hypotheses.

The aim of the research described in this thesis was to investigate how student learning outcomes may be enhanced in an AOD. Study 2 was designed to pursue aspects of AOD assessment raised in Study 1, and so provide further insight into the overarching research question for this thesis.

The research underlying Study 2 focused on the inconclusive results of the previous study pertaining to the use of a post-AOD assessment. Study 2, therefore, was designed to compare two different assessment approaches on the impact on critical thinking using student perspectives. Additionally, student awareness of critical thinking concepts and skills was explored.

The method used in Study 2 is presented in the next chapter.

Chapter 8
Study 2 Method

8.1 Introduction

This chapter describes the methodology used to answer the research questions relating to Study 2. The results from Study 1 were inconclusive regarding the use of a post-AOD assessment for AOD, however the literature suggests that a post-AOD assessment has the potential to facilitate critical thinking in students. Therefore, Study 2 was designed to investigate the impact of two different assessment approaches on student critical thinking in an AOD, and student awareness of critical thinking concepts and skills after participating in an assessed AOD.

The methodological approach is first described in Section 8.2 in general terms, followed by how this methodology was applied in Study 2. Section 8.3 presents the background and recruitment of the participants. The design of Study 2 is discussed in Section 8.4, and the ethical issues in Section 8.5. A discussion of the instrument development follows in Section 8.6, the study's procedure in Section 8.7, and validity considerations in Section 8.8. The chapter concludes with a discussion of the statistical data analysis in Section 8.9.

8.2 Methodological approach

The type of methodology used in any research should be guided by the research questions to be answered and the goals of the study (Creswell, 2008; Morgan, 1998). A research method may be either quantitative or qualitative. Alternatively, a

combination of both may be used in a mixed method approach. Mixed methods research may be defined as a design that collects both quantitative and qualitative data in a single study, and analyses and reports on the data based on the priority and sequence of the information (Creswell, 1994; Denscombe, 2010).

The basic premise for adopting mixed methods research is that the use of combined quantitative and qualitative methods provides a better understanding of the research problem than either method alone. For example, a study collecting mainly quantitative data may seek clarification and elaboration of the quantitative data via follow-up interviews (Aldridge, Fraser, & Huang, 1999). The supporting qualitative data collected in the interviews should produce a deeper understanding of the issues than may be possible from the analysis of the quantitative data alone. In a reverse scenario, focus groups may be used to collect qualitative data, the results of which may then be used to develop a questionnaire for a follow-up quantitative stage (Myers & Oetzel, 2003). Mixed methods research aims to bring together the advantages of both quantitative and qualitative methods (Creswell & Plano Clark, 2007). Quantitative research has the advantage of being able to generalise the results to a large group, while qualitative research has the advantage of hearing the voices of the participants in the context and setting of the study.

Mixed methods research is characterised by the priority placed on the two forms of data being collected, the timing of the data collection together with the analysis and interpretation of the data, and how the datasets will be mixed (Creswell & Plano Clark, 2007). The different forms of data may have equal status, or one form of data may take precedence over the second form of data. In the case of unequal status, the

more important data is often called the dominant data, while the less important data may be called the less dominant or supporting data.

Data may be collected concurrently or sequentially: a single phase design collects, analyses and interprets the data concurrently, while a two phase design indicates sequential data collection methods. The combination of both quantitative and qualitative data in varying degrees of importance, in a range of sequences and mixes, can result in a multitude of various designs (Creswell & Plano Clark, 2007; Morgan, 1998; Tashakkori & Teddie, 1998). Four of the most commonly used designs in mixed methods research are explanatory, triangulation, exploratory and embedded (Creswell & Plano Clark, 2007). An explanatory two-phase research design was chosen for Study 2, which in this case consisted of an experiment followed by interviews.

The aim of the research described in this thesis was to investigate how student learning outcomes may be enhanced in AOD. The quantitative method used in Study 1 of this thesis answered the literature calls for empirical studies in AOD (Alavi, Marakas, & Yoo, 2002; Arbaugh & Hiltz, 2005; Dennen, 2005; Kienle & Ritterskamp, 2007; McKenzie & Murphy, 2000; Schellens & Valcke, 2006). For Study 2 however, because an experiment was conducted with 'real students' in a 'real course', resulting in a potentially limited sample size, a quantitative method alone would not have been ideal in terms of internal and external validity. It was therefore decided to adopt a mixed method. It was expected that the quantitative phase would provide the direction and focus for the qualitative phase, thus building a more complete and richer understanding of the research problem than would be

possible with only one method. Creswell and Plano (2007) cite several reasons for choosing mixed methods: firstly, one data source may be insufficient; secondly, a need exists to explain initial results; and finally, a need exists to enhance a study with a second method. Study 2 met all the criteria for selecting a mixed method, and adopted an explanatory two-phase research design. The first phase collected the dominant quantitative data, and the second phase collected the supporting qualitative data.

8.3 Participants

The target population for Study 2 was first year undergraduate students. Participants were thus recruited from a first year course, ICT108 Introduction to Multimedia and the Internet (hereafter referred to as ICT108), offered in a Western Australian university. This course was chosen because it consists of mainly first year, on-campus and distance education students, thus representative of the target population. The content of ICT108 includes an introduction to web page design and construction together with the associated underlying theoretical foundations, and the social and business issues relating to the Internet. The course aims to develop critical and creative thinking to produce students who are independent and lifelong learners, and in the process, improve student communication skills.

The majority of the teaching at the university is based around a two-semester academic year with each semester consisting of 14 weeks made up of 12 teaching weeks and 2 non-teaching weeks. A course coordinator is in charge of a course, and usually gives the lectures in that course. Tutors may be employed to conduct tutorials or laboratories and help with assessment marking.

The university used the web-based Blackboard Learning Management System (referred to by staff and students as LMS) as the portal for its courses. This system is widely used in tertiary education (Jenkins, 2010) and is used for both online and blended courses. LMS enables online access to lecture notes and recordings, laboratory worksheets, assessment details, supplementary resources, discussion forums and communication with teaching staff and other students within the course. Completed assessments may be submitted via LMS and feedback returned.

The formal learning activities of ICT108 included lectures and laboratories. The weekly 2-hour lectures were designed to encourage student interaction and input, resulting in the sharing of ideas and information. In the laboratories, small groups of students worked collaboratively together researching, discussing and sharing ideas in order to complete each week's assigned worksheet. An informal learning activity included the use of an online discussion forum in which students could freely discuss course related issues.

The assessments used in the course, when Study 2 was undertaken, are shown in Table 8-1. These included two web development assessments (Assignment and Project) using XHTML to design web pages incorporating CSS and JavaScript together with optional elements of animation, sound and video. Students were also required to complete two AOD on two different topics, using the discussion facility on LMS. The examination made up the final assessment, and consisted of multiple choice and short answer questions designed to test student knowledge and understanding of the subject matter.

Table 8-1: Assessment structure for the course used in Study 2

Assessment	Description	Marks
Assignment	5 page website	15%
Online Discussions	Discussion of social issues	20%
Project	15 page website	20%
Examination	Multiple choice & short answer	45%

ICT108 was chosen as a suitable environment for this study due to the emphasis placed on critical thinking and independent learning. As problem solving features strongly in information technology degrees, it is important that students develop an awareness of their critical thinking as early as possible, with first year units aiming to develop student critical thought. One of the ways in which critical thinking is developed in ICT108 is via the online discussion forum, where students are encouraged to share information with one another. Students evaluate the shared information, adding their own resources and knowledge, and in the process, build a collaborative environment. Secondly, the use of assessment in the AOD, in which the importance of critical thinking is stressed, made the course particularly suitable for Study 2.

8.3.1 Recruitment

Students were informed of the research study during Week 1 of Semester 2, 2010. The Project Information sheet (see Appendix F) was made available, and included information about the purpose and requirements of the study together with consent, participation, withdrawal and confidentiality issues related to the project.

Participants were recruited for the study using two methods: face-to-face and online. During the first lecture of the semester the Project Information sheet was distributed. The study was explained, and students were invited to ask questions or seek clarification. The second method of recruitment was via an announcement on the home page of the ICT108 LMS website. The announcement described the project, and the Project Information sheet was made available to download. As was done in the lecture, students were invited to ask questions or seek clarification. The second method of recruitment was used to inform off campus students, and those students not present at the lecture, about the project.

The second phase of Study 2 involved interviewing participants about their experience of the discussion and critical thinking, and recruitment for these interviews was done via email and telephone (See Appendix G).

As an incentive to participate in the research, participants were given two cinema tickets for their time and effort in the first phase of the study, and those participants who were later interviewed were given a $20 retail gift voucher.

8.4 Design

This section gives an overview of Study 2 describing its activities and schedule. Study 2 consisted of two phases: an Intervention Phase, investigating the influence of two different assessment approaches on student critical thinking, and an Interview Phase, examining student awareness of critical thinking concepts and skills after completing an AOD with assessment.

The Intervention Phase investigated the effect of two different forms of assessment on student critical thinking: an AOD contribution assessment and a post-AOD assessment. Participants were allocated to one of two groups for the AOD, with each group completing one of the aforementioned assessments for Study 2.

The impact of the different assessments on student critical thinking was measured in two ways. Firstly, participants' perceptions of their critical thinking were collected prior to the AOD, using the pre-AOD questionnaire (see Appendix H) and, after the AOD and associated assessments were completed, using the post-AOD questionnaire (see Appendix I). Secondly, an objective measurement of participant critical thinking was obtained after the AOD and the associated assessments were completed. While the use of an objective test to measure student critical thinking skills before and after the treatments would have been preferable, as Study 2 was conducted in a real educational setting several limitations existed. Firstly, as students, the participants had the usual demands of study commitments, while at the same time, albeit voluntarily, they were completing tasks for a research project. Secondly, access to these potential participants was restricted to the semester period. As such the use of an objective test, which generally requires a considerable time investment, and an appropriate interval between administrations, was somewhat problematic.

The Intervention Phase used a quasi-experiment with a pre-test/post-test between-group design. Quasi-experiments have the advantage of providing intact groups to measure the effect of an intervention in a natural social setting, and are often the choice of design in information systems and education research (Creswell, 2008). While true experiments have a high degree of validity, quasi-experiments usually

have more threats to validity which need to be addressed to ensure the results of the quasi-experiments accurately reflect, as much as possible, the cause-and-effect inference under investigation, so that the results can be generalised beyond the particular circumstances of the study (Creswell, 2008; Emory & Cooper, 1991). The internal and external validity issues relating to the quasi-experiment of the current study are addressed in Section 8.8.

Table 8-2 shows how the study's tasks were arranged within the semester together with the relevant assessments used in the Intervention Phase. The two AOD for ICT108 consisted of Discussion A (see Appendix J) held in Weeks 4-5, and Discussion B held in Weeks 11-12 (not part of Study 2). For these two AOD all enrolled students were randomly allocated to one of two groups, with the study participants being equally distributed amongst the two groups.

Table 8-2: Semester week timeline for the Intervention Phase

	Wks 1 - 2	**Wks 4 - 5**	**Wk 7**	**Wks 8 - 9**	**Wk 9**
Group 1	Pre-AOD questionnaire	Discussion A	AOD contribution assessment	Post-AOD questionnaire	Objective test
Group 2	Pre-AOD questionnaire	Discussion A	Post-AOD assessment	Post-AOD questionnaire	Objective test

For Discussion A, one group of students had an AOD contribution assessment, while the other student group completed a post-AOD assessment in the form of an essay. The effect of these two different forms of assessment on student critical thinking was examined. Later in the semester, all students completed Discussion B for which the

assessment was reversed, with students who completed the AOD contribution assessment now completing the post-AOD essay assessment, and the students who had completed the post-AOD assessment in Discussion A, now having an AOD contribution assessment. This was to ensure both groups of students had the same pedagogical experience in the course; however, only Discussion A and its associated assessments and student experience was considered for Study 2.

Regardless of the form of assessment used in an AOD, suitable discussion topics are needed for active engagement within the discussion allowing students to exercise critical thinking (Andresen, 2009; Rovai, 2007; Vonderwell et al., 2007). Authentic and challenging discussion topics stimulate interaction and dialogue among participants, encouraging them to bring new information to the discussion (Dysthe, 2002). These considerations were taken into account when creating the discussion topics used in ICT108. Discussion topics were chosen that were interesting and relevant to students and constructed to elicit student interest and discussion. Prior to the commencement of the online discussion, a lecture was given on Internet social issues engaging students in whole class discussion with the aim of motivating and preparing them for the online discussions.

An essay was used as the post-AOD assessment because it provides the opportunity for students to potentially utilise a number of skills requiring critical thinking such as deconstructing, researching, evaluating, synthesising and communicating (Dennen, 2008a; Vonderwell et al., 2007).

During the Intervention Phase, the information needed to measure student critical thinking skills was collected and measured in two different ways: student perceptions and an objective critical thinking test. Student perceptions were derived from information collected in the pre-AOD questionnaire completed in Weeks 1 and 2, prior to the commencement of Discussion A, and in the post-AOD questionnaire, completed in Weeks 8 and 9, after all the Discussion A assessments were finalised. An objective measurement of student critical thinking was completed in Week 9.

In the Interview Phase, qualitative data was collected using one-on-one semi-structured interviews with open-ended questions. The interviews were designed to follow up on the information collected using the earlier instruments, and to gain insight into participant thoughts and feelings about AOD, essay writing and critical thinking.

Interviews have a number of advantages over other forms of qualitative data collection (Denscombe, 2010; Oates, 2006). Interviews allow the exploration of a topic in depth and detail, and offer flexibility in adjusting the lines of enquiry. Interviewees often appreciate having their opinions and views sought, while others may actually enjoy the process of being listened to. Interviews generally enjoy a high response rate, and the logistics of interviewing are relatively easy. The personal setting of an interview seemed the most appropriate for collecting information on participants' opinions and experiences, and to follow up on the results from the Intervention Phase. Though interviews may be designed with set questions, the flexibility of one-on-one interviews allows participants to be quite forthcoming in

sharing information and experiences they considered relevant. Finally, the audio recording of an interview allows accurate records of the conversations.

8.5 Ethics

Ethics approval for the study was sought in January 2010, and obtained the following month (permit number 2010/018). The main ethical concern was that the researcher was also the coordinator of the course at the time of the proposed study, hence creating a potential conflict of interest. This concern was addressed by the researcher having no knowledge of student participation or nonparticipation in the project. This was achieved in two ways: firstly, by the use of a research assistant to liaise between the course coordinator and the study participants; and secondly, the researcher was unable to access any of the collected data until after the semester's results were released to students.

The department employed an administrative contact for students, and this person performed the role of research assistant for Study 2. The research assistant managed the recruitment process, handled all correspondence with the study participants, conducted the group allocations, stored all of the study's data in accord with ethical guidelines, and created identification codes for the participants so that they could not be identified by the researcher.

After the completion of the study's first phase, the researcher was no longer the course coordinator. As a result, an ethical amendment was submitted requesting that the researcher be permitted to conduct the follow-up interviews, which necessitated the identification of the project participants. This amendment was approved,

providing that the research assistant make the initial contact to invite participants for interviewing.

8.6 Instruments

Several data collection methods were used in Study 2. Table 8-3 summarises the constructs used in addressing the research questions and hypotheses, and the instruments used to collect the information for these constructs. The construct *perceived critical thinking skills,* was defined as the self-reported level of critical thinking, and includes skills used for analysis, interpretation, evaluation, synthesis and inductive and deductive reasoning. This construct was used to address Hypothesis 2.1 for those students who completed the AOD contribution assessment, and similarly, used to address Hypothesis 2.2. The information needed for this construct was obtained from the pre-AOD and post-AOD questionnaires. *Perceived critical thinking skills* and *measured critical thinking skills* (from an objective critical thinking test), for each group of students who completed the different assessments, were compared to address Hypothesis 2.3. Research question 2.2 was addressed using *perceived critical thinking knowledge,* defined as the self-reported level of knowledge about critical thinking including how critical thinking is learnt and developed. This measure was obtained from the post-AOD questionnaire. Qualitative data, obtained from the questionnaires and the interviews, was also used to supplement the results obtained via the quantitative data. Sections 8.6.1 to 8.6.3 describe the instruments that collected the information needed for these constructs.

Table 8-3: Study 2 research questions and hypotheses with constructs and associated data sources

Research questions / hypotheses	Constructs	Data source
RQ 2.1: How do different forms of assessment used in an AOD affect student critical thinking skills?		
H 2.1: Students will perceive an improvement in their critical thinking skills after participating in an online discussion with an AOD contribution assessment.	*Perceived critical thinking skills*	Pre-AOD & post-AOD questionnaires
H 2.2: Students will perceive an improvement in their critical thinking skills after participating in an online discussion with a post-AOD assessment.	*Perceived critical thinking skills*	Pre-AOD & post-AOD questionnaires
H 2.3: Critical thinking skills will be more evident in students who complete a post-AOD assessment than in students who complete an AOD contribution assessment.	*Perceived critical thinking skills* & *measured critical thinking skills*	Pre-AOD & post-AOD questionnaires & objective test
RQ2.2: What is student awareness of critical thinking concepts and skills after participating in an assessed AOD?	*Perceived critical thinking knowledge*	Post-AOD questionnaire

8.6.1 Perceptions of critical thinking questionnaires

Two measures of critical thinking were used in Study 2, the first of which was participants' perceptions of their own critical thinking. Participants were asked for their perceptions of their critical thinking skills so that changes to their thinking could be examined. This information was collected prior to the commencement of the AOD, and again after all assessments had been completed.

Although few studies have measured student perceptions of changes to their critical thinking, one such study analysed philosophy students' perceptions regarding attempts to facilitate their development as critical thinkers (Mummery & Morton-

Allen, 2009). The instrument used in this study was based on the California Critical Thinking Disposition Inventory which has been reported to have an overall Cronbach alpha ranging from .71 to .90 (Facione & Facione, 1992; Ip et al., 2000; Profetto-McGrath, 2003; Yeh, 2002), and acceptable levels of construct validity (Facione & Facione, 1992; Ip et al., 2000). The instrument developed by Mummery and Morton-Allen (2009) was therefore used as the basis for the two self-perception questionnaires for the current study, after permission to do so was granted.

SurveyMonkey.com™, an online survey software and questionnaire tool, was used to facilitate construction, online access and administration of the questionnaires. Both the pre-AOD questionnaire (see Appendix H) and the post-AOD questionnaire (see Appendix I) consisted of items to measure the constructs, *perceived critical thinking skills,* and *perceived critical thinking knowledge*.

Perceived critical thinking skills was measured by 17 items (see Table 8-4) using a Likert scale from 1 ‘strongly disagree’ to 5 ‘strongly agree’. These 17 items covered thinking skills associated with argument, assumptions, conclusions, judgement and tolerance. The responses to these items were added together to obtain *perceived critical thinking skills,* with a possible maximum score of 85 for each participant. The more the participant agreed with the statements the higher their score, indicating that the participant perceived that they possessed a high level of critical thinking.

Table 8-4: Items used to measure *perceived critical thinking skills*

I use reasons and evidence to try and gain the best possible understanding of a given situation.
I am tolerant of the opinions and ideas of others, especially when they are different from my own opinions and ideas.
I carefully consider the possible outcomes or consequences of situations, choices, proposals or plans and to take this into account when making decisions.
I solve problems in an orderly, organised way.
I am confident in my reasoning and judgment to solve problems and reach my goals.
I am curious and eager to learn/understand new things, even when I'm not sure how or why this learning might be useful.
I do not see problems and situations as black or white, right or wrong.
I recognise that there is often a number of ways to solve a problem or reach a goal.
I understand the need to stand firm in my judgment when there is reason to do so, and to change my mind when reasons and evidence indicate that I am mistaken.
I understand the idea that we sometimes need to make a decision or judgment even in the absence of complete knowledge or when there is no clear right or wrong answer.
I am able to work out how true or false the inferences or conclusions are that someone draws from a particular set of information or data.
I am able to work out what hidden assumptions have been made in a given statement.
I am able to weigh evidence and decide whether generalisations or conclusions based on given data are warranted / justifiable.
I am able to distinguish between strong, relevant arguments and arguments that are weak or irrelevant to a particular question or issue.
I am able to critically evaluate academic writing (e.g., journal articles, books).
I am aware of what is needed to construct good arguments.
I aware of the need to monitor, evaluate and adjust my own thinking processes.

Perceived critical thinking knowledge was measured by six items (see Table 8-5), again using a Likert scale from 1 ‘strongly disagree’ to 5 ‘strongly agree’. The responses to these items were added together to obtain *perceived critical thinking knowledge* with a possible maximum score of 30 for each participant. The more the participant agreed with the statements the higher the score, indicating that the participant perceived they possessed a high level of critical thinking knowledge.

Table 8-5: Items used to measure *perceived critical thinking knowledge*

I have a clear understanding of the term ‘critical thinking’.
Critical thinking is closely related to reading and writing.
Critical thinking is only developed and improved through practice and the application of skills.
I am aware of the skills involved in thinking critically.
Critical thinking can be learnt easily.
I am fully aware of what critical thinking is and now only need to put into practice what I have learnt.

The post-AOD questionnaire was administered after the AOD and associated assessments were completed. The questionnaire included the same items as were used in the pre-AOD questionnaire to measure participants’ *perceived critical thinking skills* (see Table 8-4), *perceived level of critical thinking development*, and *perceived critical thinking knowledge* (see Table 8-5). The post-AOD questionnaire also included several additional items addressing the online discussion and the post-AOD essay assessment (see Table 8-6). All participants were asked, using a Likert scale from 1 ‘strongly disagree’ to 5 ‘strongly agree’, if they felt the AOD had contributed towards developing their critical thinking skills. An option was included

for participants to give ways in which they felt the AOD had contributed towards developing their critical thinking skills.

Table 8-6: Items addressing the contribution of an AOD towards developing critical thinking skills

All participants	I feel that the online discussion contributed towards developing my critical thinking skills.
Those participants who had submitted an essay for Discussion A	I feel that the process of researching and writing the essay contributed towards developing my critical thinking skills.

Those participants who had completed the post-AOD assessment were also asked, using a Likert scale from 1 ‘strongly disagree’ to 5 ‘strongly agree’, if they felt the post-AOD essay had contributed towards developing their critical thinking skills. An option was included for participants to give ways in which they felt completing this assessment had contributed towards developing their critical thinking skills.

A final open-ended item of the questionnaire invited all participants to comment on any aspect of critical thinking, online discussion, or essay writing that they felt was relevant to the study. When adding the additional items in the post-AOD questionnaire, care was taken to ensure that the questionnaire could still be completed within twenty minutes, the recommended maximum time for completing such an instrument (Fink, 1998; Wilkinson & Birmingham, 2003).

8.6.2 Critical thinking test

The second measure of critical thinking skills used in Study 2, *measured critical thinking skills*, was an objective measurement of participant critical thinking skills.

Several commercially designed tests are available to assess critical thinking; for example, California Critical Thinking Skills Test (Facione, Facione, & Winterhalter, 2010), Cornell Critical Thinking Test (Ennis, Millman, & Tomko, 1985), Watson Glaser Critical Thinking Appraisal (Watson & Glaser, 1980), Measure of Intellectual Development Test (Moore, 1990), and The Ennis-Weir Critical Thinking Essay Test (Ennis & Weir, 1985). These tests measure critical thinking either indirectly, using a multiple-choice format, or directly, using a constructed response format usually in the form of an essay or a short piece of prose (US Department of Education, 2000). Study 2 opted to use the indirect method, employing a multiple-choice format, due to the higher reliability estimates and higher predictive validity usually associated with this type of format, as well as its ease of administration and scoring (US Department of Education, 2000). A multiple-choice test was also chosen because it could be completed within 45 minutes, whereas direct testing often extends beyond two hours, an unrealistic time commitment to expect from the student participants.

The test used for Study 2 was the California Critical Thinking Skills Test (CCTST) (Facione et al., 2010), which has been developed over a 25 year period, and is one of the most widely used critical thinking tests (Bartlett & Cox, 2002; Butchart et al., 2009; Duphorne & Gunawardena, 2005; Kennison, 2006; Yang et al., 2008). The test's wide support provides some indication of its endorsement. However, reliability and validity measures were examined, prior to choosing the CCTST for use in Study 2.

The CCTST Form 2000, the current version at the time of Study 2, was reported as having an internal consistency reliability (measured using KR-20) of .78-.82

(Facione et al., 2010) The CCTST is considered to have strong content validity as it was conceptualised from a critical thinking definition developed by a panel of experts (Facione, 1990). The test's criterion validity has been established with several alternative tests all measuring .40 and above (Facione et al., 2010) Both the test authors and independent studies that have used the CCTST to document gains in critical thinking skills support the test's construct validity (Carrington et al., 2011; Facione et al., 2010; Van Gelder, Bissett, & Cumming, 2004; Yang et al., 2008).

The Form 2000 version of the CCTST consists of 34 multiple choice type items assessing analysis (including interpretation), evaluation (including explanation), inference, and deductive and inductive reasoning through the use of diagrammatic and text-based contexts. These terms are defined in Table 8-7, along with the numbers of the test items measuring each domain.

The test takes 45 minutes to complete, with the computer generated scores immediately available to test-takers upon completion of the test. The CCTST reports six scores: an overall critical thinking skills score, and five subscale scores for the skills of analysis, evaluation, inference, deductive reasoning, and inductive reasoning. Also included with the five subscale scores is a description of the related skill, along with indicative levels of weakness or strength in that skill. The overall critical thinking skills totals were used in Study 2 to compare the differences between the groups of participants completing the different types of assessment.

Table 8-7: Description of skills evaluated in the CCTST (Facione et al., 2010)

Skills & item testing that skill	Description
Analysis and Interpretation Items 1 - 9	These skills are used to closely examine ideas, to identify assumptions, reasons and claims, and to gather detailed information from charts, graphs, diagrams, paragraphs, etc. These skills are also used when determining the precise meaning of a sentence, passage, text, idea, assertion, sign, signal, chart, etc. in a given context and for a given purpose. Good interpretation often involves properly categorizing information, decoding the significance of what a person is saying and clarifying what something means. It would be unwise to build further judgments, such as inferences and evaluations, upon the results of a poor analysis or a mistaken interpretation.
Inference Items 14 - 24	To draw conclusions based on reasons and evidence. Inferences can be skilfully drawn from a wide variety of things including information, data, beliefs, opinions, facts, conjectures, definitions, principles, images, signs, behaviours, documents, or testimony. However, skilful inference does not guarantee that the conclusion will be true. Conclusions inferred on the basis of misunderstandings, mistaken beliefs, bad data, unreliable opinions, biased evaluations, or faulty information, for example, can turn out to be mistaken, even if reached using excellent inference skills.
Evaluation and Explanation Items 10 – 13 & 25 - 34	These skills are used to assess the credibility of claims and the strength or weakness of arguments. Evaluation skills can also be applied to form judgments about the quality of inferences, analyses, interpretations, options, opinions, beliefs, ideas, proposals and justifications. Explanation involves providing one's reasons, methods, assumptions or rationale for one's beliefs and conclusions. Reaching a correct conclusion is not sufficient for strong critical thinking. Strong critical thinking involves reaching a correct conclusion for a good reason, not by luck or on the basis of weak arguments and mistaken opinions.
Inductive Reasoning Items 25, 27 – 29, & 31 - 34	Inductive reasoning is drawing warranted probabilistic inferences regarding what is most likely true or most likely not true, given the information and the context at hand. Scientific disconfirmation of hypotheses uses inductive reasoning. Drawing probabilistic conclusions based on key examples, evidence, data, precedents, memories, testimony or relevant cases is inductive. Reasoning by analogy is inductive. As long as there is the possibility, however remote, that one's highly probable conclusion might be mistaken, one is using inductive reasoning.
Deductive Reasoning Items 1, 2, 4 & 24	Deductive reasoning moves from the assumed truth of a set of beliefs or premises to a conclusion which follows of necessity. In a valid deductive argument the conclusion cannot possibly be false if the premises are all true. Geometry, algebra, and many computer programs are deductive chains of reasoning, as are Sudoku puzzles. Activities which require following rules, definitions, laws or diagrams with exacting precision call on deductive reasoning skills.

8.6.3 Interviews

Semi-structured interviews were used in the second phase of Study 2. These consisted of open-ended questions designed to explore participants' thoughts and

feelings about online discussions, essay writing and critical thinking (see Appendix K for a list of the interview questions). Individual questions were also created to follow up on the data collected in the Intervention Phase of the study. The interviews employed a flexible format allowing participants to volunteer information, and pursue spontaneous tangents as they occurred during the conversation. Care was taken during interviewing to gain the trust of participants and establish rapport with them (Denzin & Lincoln, 2000).

The first part of the interview collected demographic information. The remainder of the interview focused on participant awareness of critical thinking and AOD related issues. Interviewees were questioned about the effect of the discussion on their critical thinking, any barriers to the discussion, and ways in which the discussion could be improved. This was followed by several questions exploring the impact of essay research and construction on critical thinking. Critical thinking was then discussed. Finally, interviewees were asked about instruction in critical thinking they had had prior to the course.

In addition to the questions that were asked of all interviewees, individual questions were created, based on the information given by the individual in the questionnaires, their AOD related assessment, and their critical thinking test result. Participants were questioned about inconsistencies in the answers given in the two questionnaires, and were asked to clarify and elaborate on the information provided to the open-ended sections of the post-AOD questionnaire.

8.7 Procedure

The Intervention Phase of the study was conducted during Semester 2 of 2010, and the Interview Phase during Semester 1 of 2011. The details of the Intervention Phase are discussed in Section 8.7.1 and the Interview Phase in Section 8.7.2.

8.7.1 Intervention Phase

Participants could complete the pre-AOD questionnaire in class, using a paper version, or online. Paper copies of the pre-AOD questionnaire were distributed in class and once completed, collected by the research assistant. The research project information, together with the link to the online version of the pre-AOD questionnaire, was also made available via the LMS course website. Students not present at the first lecture were invited to complete the online version of the questionnaire within two weeks.

The questionnaires completed on paper were digitally entered by the research assistant and saved to the same file as the online version of the questionnaire. This file was subsequently downloaded, and safely stored by the research assistant in accordance with ethical requirements.

In preparation for Discussion A, all students, including the participants of Study 2, were allocated to one of six discussion forums. The 31 students who had completed the pre-AOD questionnaire were randomly allocated to six forums, with five participants in Forums 1-5 and six participants in Forum 6. The remaining 11 students, who were not part of the study, were then randomly allocated to each forum, with two students allocated to Forums 1-5 and one student allocated to

Forum 6. Each forum thus consisted of 7 members giving a total of 42 students, the total number enrolled at the time. Despite the fact that research and the findings from Study 1 suggest 8-10 students per forum is ideal, a logistical decision was made to have three forums participate in each treatment resulting in only 7 students per forum. Finally, students in Forums 1-3 were allocated the AOD contribution assessment for Discussion A, and those in Forums 4-6 were to complete the post-AOD essay assessment for Discussion A.

In the Week 2 lecture social issues relating to the Internet were discussed, and students were invited to comment and share their experiences. This was a very lively lecture with students showing a lot of interest, particularly in the area of social networking. Social networking sites were very relevant for students with almost all of them being a member of at least one site, with Facebook™ being the most popular. Students were asked if an online discussion on privacy and social networking would appeal, and was confirmed by a large show of hands. As a result, the following topic was created for Discussion A:

> *Describe the issues relating to privacy in social networking sites, and comment on how privacy issues may impact on the future of social networking.*

Discussion A was designed around the structured assigned topic discussion format consisting of authentic discussion topic, several questions created to stimulate thought, and a set of readings (See section 2.5). The discussion assessment incorporated factors from Study 1 that were shown to have a positive impact on student critical thinking. These included the discussion aim and duration, the

minimum number of required postings, and a marking rubric, as well as submission details.

During Week 3 the assessment information (see Appendix J) was made available and discussed during the lecture. Those students participating in the post-AOD essay assessment were strongly encouraged to use discussed points in their essays, and were required to cite at least three postings from their forum in their essays. Everyone was given a week to research and gather their thoughts about the discussion topic, with the discussion forums opening at the beginning of Week 4 of the semester. All students, including the study participants, were advised to post freely and told that the course coordinator would assist if discussion faltered or stagnated, by asking questions, posting a relevant link or referring to other postings in the forum. During the actual discussion the course coordinator performed moderation in all forums by initiating discussion and questioning postings to elicit further comments from participants.

After Discussion A assessments were completed, information about the post-AOD questionnaire, including the link for online access, was uploaded to the LMS course website on Monday of Week 8. Participants were also advised about the questionnaire during lectures. Participants were asked to refer to their experience of the online discussion just completed when answering the questions. A special request was also made to spend some time and thought answering the open-ended questions relating to Discussion A. The post-AOD questionnaire remained available for two weeks and participants were given several reminders via the lecture and the LMS

course website. When the survey was closed, the data file was downloaded and stored.

During Week 9 participants were advised, both in the lecture and via the LMS course website, that the online critical thinking test (CCTST) was available for completion. Participants were provided with access details, informed that the test would require approximately 45 minutes to complete, and that individual test results would be immediately available upon completion. Subsequent reminders were placed on the LMS course website. Participants' test answers were stored online in a spreadsheet created by the administrators of the test, and accessed via an account and password. When all data collection had been completed, the file was downloaded and stored.

8.7.2 Interview Phase

The Interview Phase consisted of semi-structured interviews seeking elaboration of results obtained from the data collected in the Intervention Phase. Emails were sent to the 21 participants who had completed all the requirements of the Intervention Phase, inviting them to be interviewed.

Information about the interview and subsequent reimbursement was included in the invitation email and, upon return reply, the interview time, date and location were arranged. Follow-up telephone calls were made to those participants not responding to the email. Seven participants agreed to be interviewed.

Formal consent (see Appendix L) was obtained from each interviewee prior to the commencement of the interview, and gift vouchers given to each of them. The

consent form also included the option to permit audio recording of the interview, with all participants granting permission. Interviews were conducted in March and April of 2011, with each taking approximately 50 minutes. Once all interviews were completed, the recorded data was transcribed into Microsoft® Word, and comments relating to the interviewees' non-verbal gestures and time delays in answering questions added. Conversation that veered from the immediate topic under discussion was not transcribed, but noted, and could be revisited if relevant. As only seven participants were interviewed, data analysis was performed using the Microsoft® Excel spreadsheet program.

8.8 Validity

When conducting any experiment, issues relating to the internal and external validity of the results need to be considered and minimised (Campbell & Stanley, 1966). Internal validity relates to the cause-and-effect inferences, meaning that the conclusions drawn about the experimental relationship actually imply cause. The main threats to internal validity in a quasi-experiment are *maturation*, *selection*, *treatment*, *mortality*, *regression*, *history* and *procedure* (Campbell & Stanley, 1966; Creswell, 2008).

For Study 2 many of the threats to internal validity had been addressed by the fact that participants were randomly allocated to the two discussion groups. Any threat of *maturation*, which refers to how subjects may change during the course of the study, would have affected both groups equally in the current study. The *selection* threat relates to the effect of having non-equivalent groups. The random group allocation

performed at the beginning of Study 2 should have ensured that the comparison groups would be functionally equivalent.

The threats of *treatment* cover a range of issues that may arise as a result of subjects feeling that they have been disadvantaged in some way, as a result of being in one group as opposed to the other. The *mortality* threat refers to the potential bias that occurs if one comparison group experiences a higher level of subject withdrawal than the other group, thus resulting in possible differences between groups. In Study 2, the treatments experienced by both groups were part of their course assessments, and so all participants would have experienced them regardless of the study. Additionally, any withdrawal from Study 2 could not be attributed to any differences in treatment between the comparing groups, as both groups received identical treatment over the course of the semester. Thus any potential bias resulting from mortality differences between the groups was not identified as an issue. In fact, the percentage of participants between the comparison groups barely changed at all as a result of the 10 participants who completed the first data collection activity only. The group completing the assessed AOD had 16 (51.6%) of the initial total of 31 participants, and after withdrawals had 11 (52.0%) of the final total of 21 participants, while the group completing the post-AOD essay assessment had 15 (48.4%) of the initial total of 31 participants, and after withdrawal had 10 (47.6%) of the final total of 21 participants.

The *regression* threat, whereby study groups are selected on the basis of their extreme scores, was not an issue as there was no selection based on any previous scores of the participants.

The *history* threat relates to an event that may occur to confuse the relationship being studied, and for this study, participants may have had exposure to instruction on critical thinking from other courses while being part of Study 2. This potential threat was addressed in the interviews, when participants were questioned about their exposure to critical thinking, both during and prior to the study. In this way, any current or prior instruction could be acknowledged.

The *procedure* of the study may present a threat if participants are aware of outcome measures, and remember responses for later testing. This may occur especially in pre-test and post-test situations, and may have been an issue in Study 2 if participants remembered their responses to pre-AOD questionnaire when completing post-AOD questionnaire. However, this was considered unlikely given the large number of questions.

A study has good external validity if the results can be generalised beyond the set of circumstances of the study, so that if the experiment is repeated at another time or in another setting, the results would be the same. The main threats to external validity include: the use of participants who may not be representative of the population to which the results apply; the particular setting of the study, which may prevent the applicability of the results; and factors present at the time of the experiment that may not be present if the experiment were repeated at another time (Creswell, 2008). Study 2 recruited participants from a student sample typical of the target population of first year undergraduate students, to which the study results apply. The setting of Study 2 was a real educational environment and the experience is typical for many students.

8.9 Data analysis

Data analysis was conducted as shown in Table 8-8, using both quantitative and qualitative methods, which are discussed in Sections 8.9.1 and 8.9.2 respectively.

Table 8-8: Study 2 research questions and hypotheses with data sources and data analysis

Research questions / hypotheses	Data source	Data analysis
RQ 2.1: How do different forms of assessment used in an AOD affect student critical thinking skills?		
H 2.1: Students will perceive an improvement in their critical thinking skills after participating in an online discussion with an AOD contribution assessment.	Pre-AOD & post-AOD questionnaires	Paired-samples t-test
	Post-AOD questionnaire & interviews	Thematic analysis
H 2.2: Students will perceive an improvement in their critical thinking skills after participating in an online discussion with a post-AOD assessment.	Pre-AOD & post-AOD questionnaires	Paired-samples t-test
	Post-AOD questionnaire & interviews	Thematic analysis
H 2.3: Critical thinking skills will be more evident in students who complete a post-AOD assessment than in students who complete an AOD contribution assessment.	Objective test[α] & pre-AOD & post-AOD questionnaires	Independent samples t-test
RQ2.2: What is student awareness of critical thinking concepts and skills after participating in an assessed AOD?	Interviews & post-AOD questionnaire	Thematic analysis

[α] CCTST

8.9.1 Quantitative analysis

Quantitative data were analysed using IBM® SPSS® Statistics 20. Descriptive statistics including means, minimum, maximum and frequencies were used for the

demographic data of the participants, and in analysing the responses for the participants' perceived critical thinking knowledge.

Cronbach's alpha coefficient was established as an indicator of reliability for *perceived critical thinking skills* and is reported in Section 9.3. Testing the data samples for normal distribution, also reported in Section 9.3, was conducted both visually, using histograms and stem-and-leaf plots, and objectively, using the Shapiro-Wilk test (D'Agostino et al., 1990; Shapiro & Wilk, 1965).

Data samples were found to be suitable for parametric testing with the paired-samples t-test used to address Hypotheses 2.1 and 2.2, and the independent samples t-test used to address Hypothesis 2.3, as shown in Table 8-8. The analysis of qualitative data, which supported the findings suggested by quantitative analysis, is discussed in Section 8.9.2 below.

8.9.2 Qualitative analysis

Qualitative data, collected from the interviews and the post-AOD questionnaire, were analysed using a categorising strategy for the coding (Maxwell, 2005). The interviews sought to clarify and elaborate on the responses given in the questionnaires, and asked participants for their views of AOD, associated assessments, and critical thinking. After the transcription process was complete, the analysis of the information was carried out using the following steps:

1. Time was spent immersed in the data, repeatedly listening to the digital recordings, while simultaneously following the transcriptions, documenting and highlighting areas of potential interest.
2. The interview questions were used as organisational categories which were set up in a spreadsheet. The relevant interview comments associated with each interview question were then copied from the transcriptions into the spreadsheet.
3. The individual comments for each question were then examined and themes (substantive categories) identified. Appendix M gives an example of the analysis after this stage, showing the potential themes highlighted in a sample of the comments in responses to the interview question: *How would you define critical thinking?*
4. Phrases and words that represented the themes were then extracted from all comments, and the data re-grouped according to themes.

All of these steps included the iterative process of defining and refining the themes where applicable, along with continual checking against both the full transcript of each participant, and the digital recording to ensure contextual accuracy.

The second source of qualitative data was the open-ended questions in the post-AOD questionnaires. Participants were asked for ways in which they believed the AOD and the applicable assessments contributed to their critical thinking. The final item in the questionnaire invited participants to make any relevant comments about AOD, associated assessments or critical thinking in general.

The same categorising strategy was carried out on these data in much the same way as was done with the interview data. The analysis of the questionnaire comments involved copying all the comments into a new spreadsheet file and used the items of the questionnaire as the organisational categories. The responses to each item were closely examined and emerging themes identified.

8.10 Overview

This chapter described the design of Study 2, and commenced with a rationale for selecting a mixed method utilising an explanatory two-phase research design. The Intervention Phase collected the dominantly quantitative data via questionnaires, with the Interview Phase collecting the supporting qualitative data.

Study 2 used a quasi-experiment in a real education setting with first year undergraduates. All students were randomly assigned to complete either an AOD contribution assessment or a post-AOD assessment. Using this setting the impact of the different assessment approaches on the levels in critical thinking skills were compared before and after the assessed AOD. Student perceptions of their critical thinking skills, together with a post-AOD objective measurement, were collected to evaluate improvements in critical thinking skills. The subsequent results obtained from this phase would shed light on how different assessment approaches can be used in an AOD, particularly the use of a post-AOD assessment, as little research has been reported on the use of such an assessment approach.

Student awareness of critical thinking concepts and skills was collected mainly from the semi-structured interviews held in the semester following the Intervention Phase.

In these, participants were asked to elaborate on comments given in the questionnaires and to obtain their views on critical thinking, AOD, and the use of assessment in AOD. This information will give insight into student awareness of critical thinking, and help educators to direct critical thinking instruction in those areas where it is most needed.

The following chapter presents the detailed discussion of the analysis of the information collected in Study 2.

Chapter 9
Study 2 Results

9.1 Introduction

This chapter reports on the results of the Study 2 data collection and analysis that were carried out as described in Chapter 8. The chapter begins with a presentation of the participants' demographic information in Section 9.2. Section 9.3 presents the results of using two different assessment approaches in an AOD: an AOD contribution assessment and a post-AOD assessment. Section 9.4 presents the results of the data analysis pertaining to overall levels in student critical thinking skills, as well as student awareness of critical thinking concepts and skills.

9.2 Participants

At the commencement of Study 2, 42 students were enrolled in the course in which the study was conducted. Although 31 of these completed the initial questionnaire, only the information of 21 participants who completed all the requirements of Study 2 was used in the analysis. Six participants (28.6%) were female and 15 (71.4%) were male. The gender ratio of participants in Study 2 was the same as that in the course at the commencement of the study where 12 (28.6%) students were female and 30 (71.4%) were male. The ages of the 21 participants in Study 2 ranged from a minimum of 17 to a maximum of 41 years, with an average of 20.8 years.

Of the 11 participants who completed the AOD contribution assessment, two (18.2%) were female and nine were male (81.8%). Their ages ranged from a minimum of 17 to a maximum of 41 years, with an average of 21.5 years.

Of the 10 participants who completed the post-AOD assessment, four (40.0%) were female and six (60.0%) were male. Their ages ranged from a minimum of 17 to a maximum of 32 years, with an average of 20.0 years.

Seven of the 21 participants were subsequently interviewed. Three were female, aged 18, 24 and 32, and four were male, all 18 years old. Five participants were native English speakers. Mandarin was the first language for one female participant and Singlish, the colloquial Singaporean English, was the first language for one male participant.

Three of the seven interview participants, one female and two male participants, had completed the AOD contribution assessment, while the other four participants, two female and two male, had completed the post-AOD essay assessment.

None of the interview participants had significant previous experience of an AOD, with five participants having never experienced an online discussion prior to that undertaken during Study 2. Of the remaining two male participants, one had experienced AOD in previous courses, and the other had participated in internet forums, which he felt were completely different from the AOD in the course in which the study was conducted.

All 21 participants in Study 2 completed the CCTST to obtain an objective measure of their critical thinking skills. The mean for the 21 participants was 15.95 (SD = 4.09), with a minimum of 6 and maximum of 22 (a possible maximum result is 30). The mean for the participants was slightly higher than the mean of 14.70 for 2-year college students in the United States as reported by the authors of the test (Facione et al., 2010). Seventeen of the 21 participants had individual *measured critical thinking skills* in the satisfactory range of 12 to 24 (according to Facione), with the remaining four students having *measured critical thinking skills* between 6 and 11, indicative of low levels in skill performance.

Comparing the results obtained in Study 2 with those of similar studies is somewhat problematic as the test version may not be reported (Al-Fadhli & Khalfan, 2009; Yang et al., 2008), a different version used (Angeli & Valanides, 2009), or students are at a different level in their studies (Cisneros, 2009). However, a study of first year engineering students that did use the same test version (Form 2000) as was used in Study 2 reported post-treatment means for two different groups (Jacob, 2012). The mean obtained in Study 2 was higher than the mean of 15.62 reported for one group in Jacob's study, and slightly lower than the mean of 16.93 reported for the other group. Given this result, and in the absence of other comparisons, it may be reasonable to conclude that the critical thinking skills of the participants in Study 2 are consistent with those of first year undergraduates.

9.3 Assessments in AOD

This section presents the results of the data analysis to answer the research questions. Section 9.3.1 evaluates the effect of the AOD contribution assessment, by comparing

participants' *perceived critical thinking skills* before and after the AOD. Section 9.3.2 evaluates the effect of using a post-AOD essay assessment also by comparing participants' *perceived critical thinking skills* before and after the AOD.

Cronbach's alpha coefficient was calculated for both administrations of the questionnaire producing coefficients of .747 and .854 respectively, representing acceptable levels of internal consistency (Nunnally, 1978). All constructs were normally distributed, therefore parametric t-tests were suitable. For all of these tests used in Study 2, the value used for significance was .05.

Section 9.3.3 evaluates the two forms of assessment, by comparing the critical thinking skills of the two groups of participants completing the different assessments. The critical thinking skills of the participants were represented by their *perceived critical thinking skills* after the interventions used in Study 2, and by their *measured critical thinking skills*.

9.3.1 Improvements in critical thinking skills with an AOD contribution assessment

Higher levels of *perceived critical thinking skills* after the AOD would suggest an improvement in critical thinking skills for those 11 participants who had an AOD contribution assessment. The results of the paired-samples t-test, shown in Table 9-1, indicate that there was a small significant increase in *perceived critical thinking skills*, from prior to the AOD ($M = 66.55$, $SD = 5.39$) to after the AOD ($M = 68.82$, $SD = 6.35$), $t(10) = -2.12$, $p = .03$ (one-tailed) for the participants who had their AOD contributions assessed.

Table 9-1: Comparison of *perceived critical thinking skills* before and after an AOD contribution assessment

	N	Mean	SD	p
Pre-AOD *perceived critical thinking skills*[α]	11	66.55	5.39	.03*
Post-AOD *perceived critical thinking skills*[α]	11	68.82	6.35	

[α] possible maximum result is 85

Due to this significant result the following hypothesis was accepted:

H 2.1: Students will perceive an improvement in their critical thinking skills after participating in an online discussion with an AOD contribution assessment.

This belief that an AOD contribution assessment facilitated critical thinking was reflected in the participants' responses in the post-AOD questionnaire. When asked in a Likert-scale question whether the AOD contributed towards developing their critical thinking skills, nine of the above 11 participants 'agreed' or 'strongly agreed' that it had. The remaining two participants stated that they were unsure whether the AOD contributed to their critical thinking. Unfortunately, neither of these two supplied any elaborating information, nor did they volunteer to be interviewed. Attached to this same question was an option for participants to give several ways in which they believed the AOD had developed their critical thinking. In the data analysis of these responses two themes emerged most consistently. The first theme was that of 'exposure to different perspectives', evident in phrases such as "points of view" and "different views" as shown in Table 9-2.

Table 9-2: A sample of participants' responses associated with the theme of 'exposure to different perspectives' in AOD contribution assessment

Participants' responses
"I have learned I should look at the problems from a different angle."
"I detected others' different standpoints and that not everyone thinks the same depending on their personal and cultural background."
"Gave me a wider view of what more people thought."
"I was able to take in what other people were saying."
"Gave insight on what others thought and allowed me to discuss different viewpoints."

The second theme to emerge was that of 'argument development'. As shown in Table 9-3, participants indicated that having the AOD prompted them to not only re-evaluate their ideas, but to evaluate the ideas of others when developing their own arguments.

Table 9-3: A sample of participants' responses associated with the theme of 'argument development' in AOD contribution assessment

Participants' comments
"I am applying my argument skills and putting them into practice in the discussion."
"I think that it was important for me in developing my own arguments."
"Give people more time to rethink, reorganise his/her own thinking."
"It provoked me to respond to and analyse a problem and then repeat that process against other answers."
"By analysing someone's opinion or a source they have quoted we inadvertently make judgements about the argument and start to question the meaning."
"Look at sources and evaluate. Discuss and debate with others."
"Online discussions may help to avoid arguments that turn irrational."

Of the nine participants who had the AOD contribution assessment, and acknowledged the discussion's contribution towards their critical thinking, three

volunteered to be interviewed. The two themes of 'exposure to different perspectives' and 'argument development' were reinforced by these three participants during the interviews, as shown in the following representative comments:

> "Gave me a wider view of what more people thought and reinforced my original view."
>
> "The discussion forced me to look at it [the topic] again…makes you go through it again… see what you did right and what you did wrong, re-evaluate it and see where you slipped up."

The responses given in the post-AOD questionnaire and the interviews showed that participants felt that the AOD did help to develop their critical thinking skills by allowing access to different perspectives which helped in developing their arguments. These comments give support to the results from the quantitative analysis that showed that students perceived an improvement in their critical thinking skills after completing an AOD in which their contributions were assessed.

9.3.2 Improvements in critical thinking skills with a post-AOD assessment

Higher levels of *perceived critical thinking skills* after the AOD would suggest an improvement in critical thinking skills for those 10 participants who had a post-AOD assessment. The results of the paired-sample t-test shown in Table 9-4, indicate that there was a significant increase in *perceived critical thinking skills*, from prior to the AOD (M = 63.70, SD = 5.31) to after the AOD (M = 66.10, SD = 5.71), t(9) = -2.68, p = .013 (one-tailed), for the participants that completed a post-AOD essay assessment.

Table 9-4: Comparison of *perceived critical thinking skills* before and after a post-AOD assessment

	N	Mean	SD	p
Pre-AOD *perceived critical thinking skills*[α]	10	63.70	5.31	.01*
Post-AOD *perceived critical thinking skills*[α]	10	66.10	5.71	

[α] possible maximum result is 85

As the result was significant the following hypothesis was accepted:

H 2.2: Students will perceive an improvement in student critical thinking skills after participating in an online discussion with a post-AOD assessment.

In the post-AOD questionnaire, one Likert-scale item was created for participants to indicate the contribution of the AOD in developing their critical thinking, and another to indicate the contribution of the post-AOD essay assessment in developing their critical thinking. Nine of the 10 participants 'agreed' or 'strongly agreed' that the AOD had helped in developing their critical thinking, and one 'disagreed', but unfortunately did not give a reason. When asked about the contribution of the post-AOD essay in developing their critical thinking skills, seven of the 10 participants 'agreed' or 'strongly agreed' that it had. Two of the remaining three participants felt that the post-AOD essay assessment did not help, and the other participant was unsure. Unfortunately, none of these three participants gave reasons for their decision, nor volunteered to be interviewed, so no clarification could be sought.

In the post-AOD questionnaire the above two questions that asked about the contribution of the AOD and the contribution of the post-AOD assessment in developing critical thinking skills, also had options for participants to give ways in

which they believed either of these had helped to develop their critical thinking. In the data analysis of the ways in which the AOD had contributed, the theme that emerged most consistently was that of 'exposure to different perspectives'. Table 9.5 displays a sample of the participants' responses. This theme was also found in the analysis of participants' responses presented in Section 9.3.1. However, the theme of 'argument development' was evident in one participant's comment only, unlike that reported in Section 9.3.1:

> "it [the AOD] encourages critical thinking by forcing us to think in a way which helps us build our argument or attempt to disapprove an argument that we deem to be wrong"

Table 9-5: A sample of participants' responses associated with the theme of 'exposure to different perspectives' in post-AOD assessment

"Ideas and points of view which I didn't get myself"
"showed that other colleagues have different views of points and showed me a new way to view things"
"allowed me to consider others opinions and compare them with my own"
"The online discussion assisted in developing my critical thinking skills as it allowed me to see points of views from different sources and opinions based not completely on my own."
"made me interact with others and take into account the way they think"

When asked about how the post-AOD essay assessment helped in developing their critical thinking skills, the most frequently mentioned theme related to the skills involved in completing an essay. As the following representative comments indicate, participants believed the processes of researching, structuring and writing an essay stimulated their thought and helped to clarify thinking:

> "purely because the process of reading and writing essays as well as researching for them develops your thoughts on your own work and others",

> "Researching and writing the essay allowed me to question my own opinions based on the topic and provide a much more critical analysis".

Four of the seven participants who acknowledged both the contribution of the AOD and the post-AOD essay assessment towards to their critical thinking were interviewed. One participant commented that she favoured the AOD over the essay, for its impact on her critical thinking:

> "...different way of thinking [be]cause people have different opinions and views on a certain thing and by having these discussions you think 'oh, I didn't think of it in that kind of way' and I found that the discussion really helped in that way."

However, the two male participants believed that the post-AOD essay assessment contributed more to their critical thinking than an AOD:

> "you are going out and finding info[information] and different ways of putting the info[information] in your essay, and in the process developing skills of investigation and essay writing",

> "You start researching and finding out…then you start thinking about it [the topic] and you start developing ideas to write in an essay. You spend a good few hours writing an essay and you constantly think about it and you start to develop ideas to write in that essay."

The fourth participant stated in the post-AOD questionnaire that she believed both the AOD and the post-AOD essay assessment contributed equally towards her critical thinking, and that "the essay would have been slightly more difficult without the online discussion". In the interview this participant reinforced her initial belief with the following elaboration:

> "before I thought critical thinking is getting a sentence or a question and just thinking about it, but don't look at the negatives or positives or look at different views - that just wasn't my thing. But after the online discussion and writing the essay it did open up my view and when I write

an essay now I think about everything not just the sentence or question itself but all the surrounding issues."

The responses given in the post-AOD questionnaire, together with the elaborating comments in the interviews, showed that participants believed an AOD and a post-AOD essay assessment both contributed to developing their critical thinking skills. The AOD helped by allowing access to different perspectives, while the application of skills involved in essay research and writing contributed towards their critical thinking. At the same time however, it was acknowledged that the addition of an AOD helped to produce a better quality essay compared to one produced solely by one's own efforts. These comments give support to the finding that there was a perceived improvement in the critical thinking skills of participants after completing the post-AOD essay assessment.

9.3.3 Comparing the levels in critical thinking skills between students having an AOD contribution assessment and those having a post-AOD assessment

Measured critical thinking skills and post-AOD *perceived critical thinking skills* were used here to evaluate the critical thinking skills of the participants. The *measured critical thinking skills* for those participants who had the AOD contribution assessment were compared to the *measured critical thinking skills* of those participants who had the post-AOD assessment. Likewise the post-AOD *perceived critical thinking skills* for those participants who had the AOD contribution assessment were compared to the post-AOD *perceived critical thinking skills* of those participants who had the post-AOD essay assessment. Higher scores in both the *measured critical thinking skills* and the post-AOD *perceived critical thinking skills,*

for those 10 participants who completed the post-AOD assessment, would suggest that this form of assessment contributes to greater levels of improvement in critical thinking than having an AOD contribution assessment.

The *measured critical thinking skills* were normally distributed so an independent samples t-test was suitable to test for improvements between the two groups of participants. Similarly, an independent samples t-test was used to test for improvements in post-AOD *perceived critical thinking skills*. The results are shown in Table 9.6.

Table 9-6: Comparison of *measured critical thinking skills* and post-AOD *perceived critical thinking skills* for the two forms of assessment

		N	Mean	SD	p
Measured critical thinking skills	AOD contribution assessment	11	16.36	1.47	.32
	Post-AOD assessment	10	15.50	1.01	
Post-AOD *perceived critical thinking skills*	AOD contribution assessment	11	68.82	6.35	.16
	Post-AOD assessment	10	66.10	5.71	

There was no significant difference in *measured critical thinking skills* for those having an AOD contribution assessment (M = 16.36, SD = 1.47) and those completing a post-AOD essay assessment (M = 15.50, SD = 1.01; t(19) = .47, p = .64, one-tailed). There was also no significant difference in post-AOD *perceived critical thinking skills* between those having an AOD contribution assessment

(M = 68.82, SD = 6.35) and those having a post-AOD essay assessment (M = 66.10, SD = 5.71; t(19) = 1.03, p = .32, one-tailed).

As a consequence of these results the following hypothesis was not supported:

H 2.3: Critical thinking skills will be more evident in students who complete a post-AOD assessment than in students who complete an AOD contribution assessment.

9.4 Knowledge and awareness of critical thinking skills and concepts

The results presented in this section apply to all 21 participants. The results address student knowledge, using the construct *perceived critical thinking knowledge* from the post-AOD questionnaire, and awareness of critical thinking concepts primarily using the information collected in the interviews.

The principal purpose of the interviews was to gain insight into student awareness of critical thinking, and not to interrogate students to find out what they knew or did not know about critical thinking. However, it must be mentioned that during these interviews students experienced difficulty in articulating what they considered to be critical thinking. Participants appeared unsure and hesitant, and often qualified what they had said in case their answer was not acceptable. Due care was taken throughout the interview process to alleviate such apprehension, and reassure students that all their comments were valuable and none would be considered incorrect or inappropriate.

9.4.1 Student knowledge of critical thinking skills and concept

The measure of participants' *perceived critical thinking knowledge* was obtained from the responses to the six Likert-scale items listed in Table 9-7. The means for five of the items were above 3.5, indicating a relatively high level of *perceived critical thinking knowledge*. Students confidently indicated an understanding of the term of critical thinking (M = 3.86), and that critical thinking can be enhanced by practice (M = 3.95), but reported being a little less knowledgeable about the skills involved with critical thinking (M = 3.76). The somewhat lower mean of 2.62 for the item 'critical thinking can be learnt easily' shows some uncertainty about whether critical thinking can indeed, be easily learnt.

Table 9-7: Levels in participants' *perceived critical thinking knowledge*

Items measuring *perceived critical thinking knowledge*	**N**	**Min**	**Max**	**M**	**SD**
I have a clear understanding of the term 'critical thinking'.	21	2	5	3.86	0.79
Critical thinking is closely related to reading & writing.	21	2	5	3.71	0.96
Critical thinking is only developed and improved through practice and the application of skills.	21	3	5	3.95	0.67
I am aware of the skills involved in thinking critically.	21	2	5	3.76	0.70
Critical thinking can be learnt easily.	21	1	5	2.62	1.07
I am fully aware of what critical thinking is and now only need to put into practice what I have learnt.	21	2	5	3.57	0.81
Total of all items$^{\alpha}$	21	16	27	21.54	4.09

α A maximum result is 30.

9.4.2 Student awareness of critical thinking skills and concepts

As presented in Sections 9.3.1 and 9.3.2, the theme of multiple perspectives emerged most frequently in the post-AOD questionnaire responses relating to how the AOD contributed in developing their critical thinking. This theme also emerged very frequently in the interviews. This theme was mentioned by nearly all participants with words such as “different ideas”, “different points of view” and “seeing different sides” as shown in Table 9-8.

Table 9-8: A sample of participants' phrases/words representing multiple perspectives

“seeing all sides of the argument”, “exploring different points of view”, “lots of different opinions” “different ways of seeing a problem”, “what more people think”, “different ideas”, “different points of view”, “view points”, “different ways”, “seeing different sides”

The interview participants showed awareness that critical thinking is associated with deep thinking and looking beyond the surface. Deep thinking was recognised in words such as “deep” and “below the surface”. This was reflected in comments related to defining critical thinking and words associated with critical thinking, as can be seen in Table 9-9.

Table 9-9: A sample of participants' phrases/words representing deep thinking

“looking below the surface”, “like a deeper thought into the subject”, “beyond the surface layer”, “deep”, “below the surface”, “beyond boundaries”, “analysis”, “analytical”, “thought provoking”

The third most frequently emerging theme in the interviews related to needing evidence to support one's argument. Words such as "proof", "facts" and "evidence" reinforced this theme as can be seen in Table 9-10. In the interviews all seven participants, including the four that completed the post-AOD assessment, acknowledged the importance of evidence and argument development to critical thinking. However, as discussed in Section 9.3.2, only one participant, who was not subsequently interviewed, identified the AOD as contributing to developing his critical thinking. So, while evidence and argument development was recognised as being related to critical thinking, only one of the 10 participants who completed the post-AOD assessment identified the AOD as a place in which argument development may occur.

Table 9-10: A sample of participants' phrases/words representing evidence and argument development

"points that would support what you are thinking", "evidence to support a stance", "creating arguments for and against", "build our argument or attempt to disapprove an argument", "someone else can say well I don't think this at all", "I think this and that whole sort of back and forth thing", "proof", "facts", "references", "point and counterpoint", "evidence", "reasoning"

The terms 'evaluate' and 'analysis', along with their variations, were frequently mentioned throughout the interviews but without direct reference to any of the aforementioned themes (see Table 9-11). 'Evaluate' was included in several responses of 5 participants, and 'analyse' was similarly used by 3 participants. One participant stated that "being critical meant being analytical". One interviewee used specialist terms such as "synthesis", "deduction", "assumption" and "premise" derived from his previous learning.

Table 9-11: Examples of terms interviewees associated with critical thinking

Terms	Participant's quotes
Evaluate	"look at sources and evaluate", "not judge, but like in an intellectual kind of way", "to judge the value of something", "my thoughts and opinions and then evaluating them to make conclusions", "evaluate"
Analyse	"analytically think about things", "analysing the topic", "analysing something critically"

Less frequently mentioned were phrases classified under the following terms, which the interviewees believed are associated with critical thinking: 'innovation', 'problem solving', 'knowledge', 'good communication' and 'questioning'. Some of these comments are shown in Table 9-12.

Table 9-12: Less frequently occurring themes emerging in the interviews

Themes	Participant's phrases/words
Innovation	"thinking outside the box", "see things in a problem or a situation that others might not notice"
Problem solving	"work through problems", "better solutions to problems", "any sort of problem solving"
Knowledge	"know a lot about a subject and have a lot of knowledge", "know about a topic", "gathering knowledge about a certain topic"
Good communication	"able to write well and put it into words", "clear about what they are talking about what they are saying"
Questioning	"continually ask questions", "question a lot - question everything", "answer your own question"

The importance of critical thinking both to academic achievement and to life in general was acknowledged with comments such as: "it broadens your academic

horizons" and that without it "we would probably be like sheep and follow each other" and again without it "there would be no people, no pens, no inventions". A final comment recognised that critical thinking is needed for "any sort of problem solving I need to do – it is extremely important".

9.5 Overview

This chapter presented the findings relating to the evaluation of the impact of two different assessment approaches used in an AOD on critical thinking. The results of the data analysis showed that both forms of assessment made a significant contribution to the development of student critical thinking as perceived by the participants of the study. These significant results were supported by the comments of the participants collected during the study.

However, though it was anticipated that a post-AOD assessment would result in greater improvements in student critical thinking than an AOD contribution assessment, the results of this study suggest otherwise. It was found that there was no significant difference in the levels of improvement in the critical thinking skills of the participants completing the different forms of assessment. The results presented in Section 9.3 therefore suggest that, although the use of assessments in AOD is important, the form of assessment may be less relevant.

This chapter also documented the findings relating to student awareness of critical thinking concepts and skills. Participants identified three aspects of critical thinking: firstly, that critical thinking involved deep thinking; secondly, that critical thinking

necessitates the consideration of various perspectives and opinions held by different people, and finally, that critical thinking involves developing an argument.

The following chapter presents the detailed discussion of the outcomes of Study 2.

Chapter 10
Study 2 Discussion

10.1 Introduction

This thesis is concerned with enhancing student learning outcomes in an AOD. In Study 1 it was reported that the use of assessment in an AOD had a significant impact on all discussion outcomes. Study 2 was designed to pursue the issue of assessment by investigating two different assessment approaches to determine the impact of each approach on the level of student critical thinking skills. The study was intended to provide insight into the optimal use of assessment in a discussion environment. Additionally, Study 2 aimed to clarify student awareness of critical thinking skills and concepts so that educators can direct instruction in critical thinking skills to those areas where it is most needed.

The findings of the data analysis for Study 2 were presented in Chapter 9. In Sections 10.2 and 10.3 the findings for Study 2 are discussed, and progress towards answering the two associated research questions is reported. The findings of the current study are situated with respect to relevant previous research. The limitations of Study 2 are discussed in Section 10.4.

10.2 Use of assessments in an AOD to enhance student learning

The findings of Study 2 showed significant improvements in students' levels of perceived critical thinking after completing an AOD with assessment. This occurred

for students who had their AOD contributions assessed, as well as for those who had a post-AOD assessment. This finding suggests that the form of assessment used in an AOD is possibly less important than the fact that assessment is included. The findings from Study 1 identified the importance of assessment in an AOD to enhance critical thinking from the instructor perspective (see Section 6.2.5). The findings from Study 2 again reinforced the importance of assessment for developing student critical thinking, but this time from the student perspective.

This Study 2 finding, linking critical thinking outcomes in an AOD with assessment, is consistent with other studies that have examined student perceptions of their learning in an AOD that included assessment (Akyol & Garrison, 2011; Arend, 2009; Birch & Volkov, 2007). All these studies have reported that students believed that participating in an assessed AOD facilitated the use of those high order thinking skills associated with critical thinking. For example, the majority of students surveyed by Birch and Volkov (2007) in whose study AOD contributions were assessed, believed having an assessed AOD helped to develop critical thinking learning outcomes such as "applying the theory to real world examples" and "thinking more deeply about key concepts".

The findings of Study 2 also revealed several ways in which AOD can contribute to student development of critical thinking. Exposure to multiple perspectives in an AOD was most frequently mentioned regardless of the assessment approach. This sharing and exchanging of ideas in an AOD has been cited in previous research as a major benefit of AOD (Birch & Volkov, 2007; Wu & Hiltz, 2004; Yang et al., 2008). Birch and Volkov (2007) reported that students found the sharing of views and

perspectives in the AOD to be particularly beneficial in developing their thinking outcomes.

The role of AOD in helping with argument development was also identified by students in Study 2. This finding is consistent with the research of Hamann (2012) and Meyer (2007), both of whom reported that students found AOD helpful for formulating and evaluating their ideas, with the time delay of an AOD allowing for reflection on the discussion postings prior to responding. Surprisingly though, it was only those students who completed the AOD contribution assessment in Study 2 who identified the contribution of argument development; this contribution was not recognised by those who completed the post-AOD assessment. Perhaps the requirement of incorporating AOD contributions into the post-AOD assessment altered the way in which the AOD was viewed by these students. It is possible that the students were so preoccupied with finding material for completing the post-AOD assessment that the opportunity for reflective thought and active engagement, which would help with clarifying their arguments, eluded them. This preoccupation with fulfilling grading requirements is not uncommon, and even graduate students have been reported to focus their attention on meeting assessment requirements in an AOD (Peters & Hewitt, 2010).

Though the findings of Study 2 showed significant improvements in the levels of perceived critical thinking after completing an AOD with assessment, at the same time, it was found that there was no significant difference in the levels of perceived critical thinking skills between the students completing the different forms of assessment. So, despite suggestions that a post-AOD assessment may provide the

opportunity for student reflection and analysis of the AOD contributions, stimulating student synthesising and evaluating skills (Clark, 2001; Greenlaw & DeLoach, 2003; Richardson & Ice, 2010), the evidence from the current study seems to suggest that the opportunity was not used, as those students completing a post-AOD assessment did not perceive greater enhancements to their critical thinking than did those who had only an assessed AOD.

Therefore, merely having a post-AOD assessment may not be enough to guarantee that students will take advantage of the opportunity to exercise their thinking skills. In a recent study by Akyol and Garrison (2011), in which education master students completed a post-AOD assessment, it was reported that students believed that the AOD alone was not sufficient to develop high order thinking, and that the subsequent assessment was needed to demonstrate "the synthesis, evaluation and summary of everything that went on in the class [online discussion]" (p. 243). However, these students also pointed out that it was the design of the course that directed them to use their synthesising and evaluating skills in completing the post-AOD assessment. The findings from Study 2 would seem to suggest therefore, that when using a post-AOD assessment, especially with undergraduate students, it is important that instructors emphasise and encourage students to direct their attention towards using the critical thinking skills associated with synthesis and evaluation.

One explanation for the lack of difference in critical thinking levels between those completing the different assessments may be found in how students in Study 2 viewed the AOD. As already discussed, students who had the AOD contribution assessment believed the AOD contributed to their critical thinking in two ways:

exposure to multiple perspectives and helping with argument development. However, these students completing the post-AOD assessment only reported the exposure to multiple perspectives and did not mention argument development. It may be suggested then, that perhaps these students doing the post-AOD assessment saw the AOD purely as a source of information, whereas the students having their contributions assessed viewed the AOD not only as a source of information, but also as a place to evaluate and develop their arguments. No reported research has examined the impact that different assessments have on how students view the AOD, and as this has important implications for teaching, it should be further investigated.

This would suggest that having a post-AOD assessment alters how students view the AOD, and that instructors using a post-AOD assessment should raise student awareness of the potential benefit of an AOD as a place to share, develop and evaluate their arguments, and not merely as place to gather material for a post-AOD assessment.

However, despite the fact that completing a post-AOD assessment did not lead to higher levels of critical thinking compared to students having their AOD contributions assessed, there is nevertheless some merit in the use of a post-AOD assessment. Firstly, as was discussed in Section 2.5.4, the use of a post-AOD assessment may be a sensible and practical approach from an instructor's perspective. Evidence indicates that reading and grading AOD postings is a very time consuming activity (Brookhart, 2004; Dennen, 2008a; Lazarus, 2003). The results of Study 1 confirmed the burden of marking the AOD postings as "too time consuming" and "difficult to use for assessment purposes". So, having a post-AOD assessment

may be a useful alternative, and ways in which it can be effectively implemented need investigation.

In summary, in attempting to answer the research question:

RQ 2.1: How do different forms of assessment used in an AOD affect student critical thinking skills?

the findings of Study 2 showed that students perceived significant improvements in the levels of their critical thinking skills after participating in an AOD with some form of assessment attached. However, there was no evidence to show that either form of assessment used in Study 2 resulted in higher levels in critical thinking skills than the other. These findings suggest that although assessment seems to be important for the achievement of critical thinking skills, the type of assessment may be less relevant.

10.3 Student awareness of critical thinking

The findings of Study 2 showed that the students undertaking an assessed AOD were able to exhibit satisfactory levels of critical thinking. Encouraging though this may seem, closer examination shows that they performed at the lower end of the satisfactory range according to Facione (2011). Secondly, the findings showed that the students perceived relatively high levels in both their critical thinking development and knowledge. However, when interviewed students were apprehensive about their critical thinking knowledge, mostly recalling the less complex concepts associated with critical thinking.

The level of critical thinking skills of the students in Study 2 appears to be representative of the targeted population of first years undergraduate students (Jacob, 2012), and is in accord with the findings of studies that have reported a lack of the more complex skills associated with critical thinking occurring in AOD (Bradley et al., 2008; Gilbert & Dabbagh, 2005; Hew et al., 2010; McLoughlin & Mynard, 2009). As a result, concern has been raised about getting student thinking beyond the basic concepts of information retrieval, memorisation and exchange typically exhibited in AOD, to that of integration and resolution, levels more representative of complex critical thinking (Garrison, 2007; Maurino, 2007; Szabo & Schwartz, 2011).

In the interviews, when questioned about critical thinking, students focused on the less complex concepts and skills. The most frequently emerging theme was that of multiple perspectives, but rather than question the different perspectives to understand the premise of the opinions and judge their worth, students emphasised collecting these perspectives as different ways of viewing the issue. Similarly, students recognised that critical thinking involves deep thinking and looking beyond the surface, but they were unable to elaborate further. Finally, it was recognised that evidence is needed to support an argument, but there was no mention of assessing the evidence or judging inferences. What were absent in this awareness of critical thinking were the more advanced concepts such as analysis, evaluation, metacognition, fair-mindedness, or the need to negotiate when creating solutions. Several students recognised the importance of critical thinking for problem solving and innovation, but did not appear to relate this to their academic life.

Though disappointing, the awareness of critical thinking shown by the students in Study 2 is similar to that reported in previous research (Hammer & Green, 2011; Hofreiter et al., 2007; Phillips & Bond, 2004). The students interviewed by Phillips and Bond (2004) described critical thinking as 'weighing up', 'looking at it from all angles', 'looking back on', and 'looking beyond what is there', with a marked absence of any mention of the more complex critical thinking concepts. Likewise, Bullen (1997) reported that his students identified skills related to an awareness of multiple perspectives as the most consistent theme relating to critical thinking, and made no mention of skills relating to using strategies and tactics, or assessing and judging evidence. It appears that little seems to have changed in the past 10 to 15 years.

The students in Study 2 experienced difficulty in articulating a description of what it means to think critically, and Phillips and Bond (2004) also commented on this, saying that, "the language used by students to describe the act of critical reflection is limited" (p. 293). This inability even to confidently describe critical thinking should be of concern to those seeking to promote critical thought in students, especially given the current advocacy of this skill both in tertiary education and the workplace.

The results of Study 2 show that students have a basic understanding of critical thinking concepts and are able to use these skills to a moderately satisfactory level. However, students are unaware of the more complex concepts of critical thinking and how to apply the related skills. Instruction needs to focus on raising student awareness in this area: instruction that illustrates flawed logic, and demonstrates how to assess evidence, judge an inference, synthesise material and negotiate solutions.

Without doubt some students are using these skills to various degrees, but may be unaware of their use of such thinking skills. In order to improve their thinking, students need to be aware of how they think and that they can change how they think. They also need be shown how to assess the effectiveness of their thinking according to the purpose, criteria and standards of the particular situation (Paul, 1995).

Studies that have attempted to raise student awareness by introducing various forms of message labelling (Bai, 2009; Schellens et al., 2009; Valcke, 2009), role assignment (De Wever et al., 2009; De Wever et al., 2007) and questions (Alexander et al., 2010; Yang et al., 2005) have reported increased levels in complex high order thinking occurring in an AOD. Therefore, if we are to raise student awareness of the complex aspects of critical thinking, these types of instruction show the way forward. However, what is also needed is for the instruction to acknowledge what students already know, and build upon their current knowledge to raise awareness of the complex concepts and skills of critical thinking.

In answering the following research question:

RQ2.2: What is student awareness of critical thinking concepts and skills after participating in an assessed AOD?

the results of the research conducted in Study 2 indicated that students have a satisfactory awareness of critical thinking. However, to a large degree, students are unaware of the more complex concepts and skills associated with critical thinking, and this lack of knowledge may prevent them from becoming fully functional critical citizens in a rapidly changing world. The findings suggest the need for

comprehensive instruction on complex critical thinking concepts both prior to the commencement of an AOD and throughout its duration.

10.4 Limitations of Study 2

There are several possible limitations that might have affected the outcomes of Study 2. Firstly, the number of students used in the sample for the experiment was relatively small. The lack of significant difference in the critical thinking skills between the two groups could be due to lack of power because of the small sample size, and a larger sample may be necessary to detect small improvements in critical thinking. Secondly, the small number of participants interviewed may limit the ability to draw conclusions from the interview findings; however, the purpose of collecting qualitative information via the interviews was to provide insight and elaboration of the quantitative findings, not to seek trends that could be widely applied (Denzin & Lincoln, 2000). Thirdly, perhaps a longer time frame than permitted in a semester may be needed to detect significant changes in critical thinking. The current study however, provides a useful starting point for further research on the efficacy of a post-AOD assessment for undergraduates, as previous studies in this area have focused on postgraduate students (Akyol & Garrison, 2011; Lea, 2001; MacKinnon, 2004), or on the impact of the post-AOD submission on the quality of the AOD (Geer, 2003; MacKinnon, 2004).

A second potential limitation relates to the fact that participants were drawn from the discipline of information technology, and so may not be representative of typical first year undergraduates. The discipline of information technology was considered to be apt for the study due to its emphasis on critical thinking and problem solving skills.

However, as only one course was used in Study 2, there was the potential for selection bias where the sample is not representative of the target population. The particular course chosen for the study does attract students from other disciplines, principally education, media and business, but at the time of the study two-thirds of the course consisted of information technology students. This limitation may be addressed in future research incorporating multiple different disciplines in a similar study.

The third limitation was that associated with conducting a study in a real educational setting. Such settings generally dictate that research needs to be completed within the semester timeframe and that the completion of research interventions by students adds to an often already over-burdened student workload. Furthermore, in real educational settings, there is a greater risk of non-participation in research interventions as students understandably place more priority on the completion of assessment items. As was discussed in Section 8.4, the current study had to accommodate two required AOD topics with the associated course assessments, while simultaneously allowing time for completion of the study's two questionnaires and critical thinking test. Consequently, it was impossible to accommodate the appropriate interval necessary between administrations of the same objective critical thinking test, prior to the second AOD topic. Additionally, the use of a real educational setting called for due respect for the participants and requests placed upon them. A future study should incorporate the use of an objective measure of critical thinking in an amended study design.

Finally, the delay between the implementations of Study 1 and Study 2 may affect the interpretation of the results. AOD adoption had dramatically increased between 2006, when Study 1 was conducted, and 2010, when Study 2 was conducted. Additionally, technological maturity was at a higher level.

There has been a significant delay between Study 1 and 2 which, in terms of technology adoption in education, could have a significant impact. with maybe just 3 years of maturity. However, by 2011 the level of maturity would have significantly increased – a further 5 years which is a lifetime in technology terms.

10.5 Overview

This chapter provided the discussion of the results of Study 2. This second study was designed to provide further insight into the overarching research question for this thesis by addressing the issues pertaining to assessment raised in Study 1.

The chapter opened by considering the impact of two different forms of assessment in an AOD on the levels of critical thinking skills of first year undergraduate students. While all students showed significant improvements in the levels of perceived critical thinking after completing the assessments there was no evidence to show that either form of assessment was more effective in improving critical thinking skills. Despite this however, the use of a post-AOD assessment still holds merit; as such an assessment appears to be a practical and efficient alternative approach to the time-consuming and burdensome approach associated with marking the actual AOD contributions.

Section 10.3 presented a discussion of students' critical thinking awareness. Though student critical thinking skill level and awareness were both moderately satisfactory, there was concern about students not exhibiting the use of the more complex skills associated with critical thinking. Students in the current study fell short in exercising analysis, evaluation, judgement or fair-mindedness. A recommendation was made that instruction is needed that acknowledges what is known by students, and builds upon this knowledge to raise awareness of these complex concepts, and guides students in applying the related skills.

Overall, Study 2 provides a useful starting point for further research into the use of post-AOD assessment as an alternative to the commonly used AOD contribution assessment.

The following final chapter delivers the conclusions for the research discussed in this thesis, along with implications for teaching and directions for further research.

Chapter 11
Conclusion

11.1 Summary of the research and its contribution

This chapter concludes the investigation into the enhancement of student learning outcomes in an AOD. The research focused on the achievement of discussion outcomes by evaluating conditions and factors conducive to quality discussion that facilitate student learning. This research provided insight into how instructors and students perceive learning in an AOD and provides guidance for practice in using the online discussion environment.

The research was guided by the overarching research question:

> *How can student learning outcomes be enhanced in an asynchronous online discussion (AOD)?*

and was addressed using two studies. Study 1 examined the impact of a range of factors on the achievement of learning outcomes in an AOD, while Study 2 focused on how two different approaches to assessment could be used to enhance student critical thinking in an AOD.

The starting point for Study 1 was to identify factors that potentially have a significant impact on discussion outcomes but about which research findings were inconclusive. The following factors were identified: providing a purpose for the AOD; the use of preparatory sessions; implementing AOD protocols; the use of assessment; and the use of moderation. At the same time, it was identified that high

order thinking and the collaborative construction of knowledge were the most commonly sought outcomes in an AOD. Less frequently cited was the improvement to student communication skills as a by-product of the reading and writing of discussion transcripts. Study 1 was designed to investigate the perceptions of instructors about the impact of the identified factors on the achievement of the most commonly sought discussion outcomes.

The results of Study 1 showed that using assessment and providing the purpose for an AOD activity both had significant impacts on all discussion outcomes. The use of a preparatory session was also shown to positively influence all discussion outcomes except those associated with low order thinking skills. The use of AOD protocols, such as implementing set discussion duration and a minimum number of required postings, was found to be influential on several different outcomes. Another important finding from the results of Study 1 was that all considered factors had a significant impact on the discussion outcome associated with critical thinking.

The effect of moderation, especially when performed by students, was examined in Study 1, but the results were inconclusive due to the low number of instructors who used students to perform moderation tasks. As was discussed in Section 6.3, studies in recent years have shed light on the efficacy of student moderated AOD, and provided insight into how student moderated AOD should be implemented to facilitate high order thinking outcomes, and promote the collaborative construction of knowledge.

In answering the research question for Study 1:

RQ1: What factors enhance discussion outcomes in a structured asynchronous online discussion (AOD)?

the research conducted in Study 1 showed that a number of factors all contribute to the achievement of different discussion outcomes, thus leaving educators with a variety of strategies that may be employed. However, providing the purpose of the AOD activity and the use of assessment significantly enhanced all discussion outcomes. These two factors should be incorporated in any AOD that aims to enhance student thinking, promote the collaborative construction of knowledge and improve student communication skills.

Different approaches to assessment were examined in Study 1; however, the results were inconclusive due to the small number of instructors that reported using any approach other than directly grading the AOD contributions. Since the use of a post-AOD assessment is supported as a worthwhile assessment approach in the literature (Akyol & Garrison, 2011; Dennen, 2008a; Richardson & Ice, 2010), and the results from Study 1 were inconclusive, a second study was specifically designed to address this issue. Additionally, given the attention in higher education on graduates competent in critical thinking together with the emphasis on critical thinking shown by the instructors in Study 1 this discussion outcome was targeted in the follow-up study.

Study 2 used a quasi-experiment with first year undergraduates in a real education setting. The commonly used approach of an AOD contribution assessment was compared with a post-AOD assessment. As Study 1 had sought the impact of factors

from the instructors' perspective, Study 2 examined the impact of the assessments from the student perspective. Additionally, as it has been suggested that a student's lack of knowledge of critical thinking concepts and skills may impair their ability to think critically (Cheong & Cheung, 2008; Hammer & Green, 2011; Phillips & Bond, 2004), student awareness of critical thinking was also examined.

The findings from Study 2 showed that all students perceived improved levels in their critical thinking skills after participating in an assessed AOD. This suggests that assessment should accompany an AOD activity that aims to enhance student critical thinking. However, students who completed the post-AOD assessment did not achieve significantly higher levels of critical thinking skills compared to those students who had an AOD contribution assessment. Despite this outcome, use of a post-AOD assessment continues to have potential, and further research is needed to examine different types of such an assessment approach.

A second interesting finding pertained to how students who completed the post-AOD assessment viewed the AOD. While students who had an AOD contribution assessment saw the AOD as a place for developing their arguments, those completing the post-AOD assessment made little such acknowledgement. This is unfortunate as an AOD is an ideal environment for testing and refining one's argument as participants question and evaluate one another's contributions. It is possible that this result indicates that assessments may alter the way in which students view the AOD: those who had their contributions assessed focused their efforts on producing quality postings that attracted grades, while the other students focused their efforts on creating quality post-AOD essays, viewing the AOD as a place to collect different

perspectives for their submissions. This apparent difference should be further investigated.

Student awareness of critical thinking was found to be mainly focused on different ways of seeing a problem via multiple perspectives. Furthermore, students looked to the AOD as the place to collect these various perspectives. Students also believed that critical thinking involves deep thinking and argument. The identification of these three elements shows that students have a basic understanding of critical thinking concepts. This was supported by the results of an objective critical thinking test that showed that the critical thinking skills of almost all students were satisfactory, and representative of their age and background, while a small minority of students performed at a lower than satisfactory level.

Although the satisfactory levels of student critical thinking skills, coupled with their awareness of critical thinking concepts and skills, was encouraging, at the same time it was disappointing that they made very little mention of the more complex critical thinking concepts and skills. Students did not appear to recognise that critical thinking also involves analysis, evaluation, metacognition, fair-mindedness, and negotiation. This important finding shows a gap in student awareness of critical thinking that needs to be addressed if critical thinking skills are to be enhanced.

In seeking to answer the research question of Study 2:

RQ2: How can the use of assessment enhance student critical thinking in asynchronous online discussion (AOD)?

the evidence from Study 2 suggests that an AOD with assessment, regardless of whether AOD contribution or post-AOD, will result in improved levels of student critical thinking. As the use of a post-AOD assessment was found to be just as effective as an AOD contribution assessment in enhancing critical thinking skills, it may then potentially be an optimal alternative to the burdensome marking load associated with an AOD contribution assessment. The findings also give insight into student awareness of critical thinking thus providing direction for future instruction in critical thinking.

Returning to the overarching research question for this thesis, substantial progress was made in answering the question:

> *How can student learning outcomes be enhanced in an asynchronous online discussion (AOD)?*

It was shown that enhancing student learning outcomes in an AOD can be achieved in a variety of ways. The use of assessment is an essential component for improving levels in all discussion outcomes, particularly those associated with critical thinking. The research also found that the use of preparatory sessions is a worthy addition to any AOD, and that providing the purpose for an AOD activity to students contributes towards their successful achievement of discussion outcomes.

11.2 Contribution to practice

During the past two decades, AOD has evolved from being a discussion space for bringing together geographically dispersed distance education students to become an integral component of online and blended learning environments. Research continues to investigate how to optimise the achievement of student learning outcomes in an

AOD. The research described in this thesis has added to this body of knowledge by providing insight into several factors shown to positively influence discussion outcomes. In particular the research has shown how different assessment approaches, especially a post-AOD assessment, can be used to enhance critical thinking outcomes in structured AOD.

The findings of the present study provide evidence in support of the use of assessment since all discussion outcomes were positively influenced by the inclusion of assessment. It is therefore recommended that assessment be a part of any AOD activity, and that the inclusion of an assessment rubric, at the commencement of a discussion, may help students to successfully achieve the assessment goals.

Furthermore, the results demonstrated that having a post-AOD assessment appears to be just as effective in improving levels of student critical thinking as the more commonly used assessment of AOD contributions. A post-AOD assessment should take the form of a culminating task that draws on the AOD discussion and requires students to evaluate and synthesise the material presented in the AOD.

However, evidence from the research conducted in Study 2 suggests that having a post-AOD assessment is not enough to guarantee students will use the accompanying AOD to extend their thinking. All but one student who completed the post-AOD assessment failed to identify the online discussion as a place for argument development. It is suggested therefore that educators include instruction on testing premises and questioning other participants, thus showing how this discussion space may be utilised for argument development.

Given the concern expressed about the time-consuming nature of grading AOD contributions (Andresen, 2009; Beebe et al., 2010; Brookhart, 2004; Dennen, 2008a), the use of a post-AOD assessment seems like a sensible and practical assessment approach from an educator's perspective, provided that the above additional suggestions are implemented.

The results of Study 1 reinforce the importance of providing students with the purpose of a learning activity, given its inclusion was shown to have a significant positive impact on all discussion outcomes. This result is consistent with previous findings (Ellis & Calvo, 2004; Finegold & Cooke, 2006; Roehm & Bonnel, 2009), and further highlights the relevance of providing the purpose for an online discussion to the achievement of AOD outcomes. Given this importance of providing the purpose for an AOD it was surprising that almost half of the instructors in Study 1 had not adopted this practice. This measure should, therefore, be included prior to the commencement of any AOD.

The research conducted in Study 2 examined, in detail, student awareness of critical thinking. The results showed that students possessed basic critical thinking skills representative of their demographic. It is recommended that in order to enhance these skills, students need to be conscious of their own thinking; this may be achieved by instruction on how to apply skills such as analysing, evaluating, and synthesising in an AOD and on how these can be further developed by self-evaluation.

Given the beneficial effects of providing the purpose for an AOD, and of using preparatory sessions, together with the findings relating to student awareness of

critical thinking, it would logical and advantageous to combine these when teaching; for example, this could be done by having a preparatory session that introduces the purpose for the AOD activity and instructs students about the complex concepts and skills of critical thinking. At the same time, these preparatory sessions should include student involvement in interactive and practical hands-on instruction.

In designing an optimal AOD, in which outcomes associated with critical thinking are sought, the results of the research described in this thesis suggest that providing the purpose for an AOD and the inclusion of assessment be essential components of such a learning environment. A post-AOD submission may be used for assessment but such an assessment should not be introduced without guidance. It is recommended that a preparatory session be introduced that instructs students in complex critical thinking concepts, and how the related skills may be applied in the AOD. The session should engage students in how participation in an AOD can enhance their thinking, and how discussion can be used to produce a better post-AOD assessment than one produced by one's own efforts or in isolation. The use of student moderation may further help students to develop critical thinking skills.

11.3 Implications for future research

Though the potential benefits afforded by the AOD environment are still not fully realised, two decades of research has contributed insight and guidance into how optimal learning can be achieved. The research described in this thesis contributes to the existing knowledge, and in the process has identified several areas for future research.

The important role of assessment in an AOD was confirmed; assessment matters for the successful achievement of discussion outcomes. However, the optimal assessment approach is still open for debate. It was shown that a post-AOD assessment can be a potentially effective and efficient assessment approach. However, before such an approach can be fully endorsed further research is required to reinforce the tentative results arising from Study 2.

Further investigation into the efficacy of a post-AOD assessment should include objective measures of student critical thinking both before and after the intervention, in addition to student perceptions, so that a more comprehensive picture of the effects of a post-AOD assessment on improving levels of student critical thinking can be obtained than was possible in the current research. Additionally, undergraduate students could be drawn from a range of disciplines. This would give a wider representation of first year students. The conclusions of such a study could then be generalised across all first year undergraduates, as well as help to verify or refute the findings of Study 2.

In Study 2, an essay was used as the post-AOD assessment as had been done in two previous studies (Lea, 2001; MacKinnon, 2004). However, such an assessment may take various forms, for example a reflective journal or log as reported by several of the instructors in Study 1. Akyol and Garrison (2011) reported that the use of a post-AOD redesign project assessment was highly successful in facilitating high order thinking in postgraduate students. Future research should investigate a similar post-AOD submission, but one that is specifically designed for first year students. Alternatively, a study could compare different forms of post-AOD assessment for

evidence of critical thinking. Such research into different forms of post-AOD submissions would shed light on the optimal form of such an assessment.

Research has demonstrated that postgraduate students have used material from an AOD to help in their post-AOD assessment (Akyol & Garrison, 2011; Lea, 2001), but the first year students in Study 2, as was discussed in Section 10.3, did not appear to take up this opportunity beyond what was prescribed in the discussion guidelines. Future research is needed that investigates how to instruct students to make optimal use of an AOD, especially when using a post-AOD assessment. The use of preparatory sessions that address logical reasoning and deduction, and how these skills can be applied in an online discussion, may help students to use the AOD for their argument development, and produce post-AOD assessments that exhibit high order thinking.

The design of an AOD itself has been shown to influence argument development in an AOD (Darabi et al., 2011; Kanuka et al., 2007; Richardson & Ice, 2010). Different types of AOD design were discussed in Section 2.5.3.1, where a debate design was reported to be most appropriate for encouraging high order thinking contributions. A future study could examine the impact of a post-AOD assessment approach on critical thinking outcomes after using a debate designed AOD. Research into either preparatory sessions or AOD design will shed light on what is required for more complex engagement in AOD than is currently being reported, regardless of which assessment approach is used.

A learner should be able to assess their own abilities accurately, and recognise critical thinking in themselves and others for learning to be effective. Information about student awareness of critical thinking is essential to focus instruction in areas where students lack awareness and knowledge. Student awareness of critical thinking has been investigated by only a few studies (Hammer & Green, 2011; Mummery & Morton-Allen, 2009; Phillips & Bond, 2004), and these, together with the findings of Study 2 provide a useful starting place for future research. Such research should evaluate the effect of critical thinking instruction designed to target those areas in which students lack knowledge on their thinking outcomes achieved in an AOD. This will help to realise the potential of AOD and produce graduates competent in critical thinking when entering the workforce.

11.4 Overview

In conclusion, the research described in this thesis represents significant progress towards understanding the successful enhancement of student learning outcomes in an AOD. The importance of assessment has been shown. The use of a post-AOD assessment was investigated and found to have potential as an alternative to that of assessing the AOD contributions. Additionally, it has been found that support in the form of preparatory sessions and the provision of a clear purpose for an AOD both have positive influences in the achievement of discussion outcomes. Finally, the insights provided about student critical thinking awareness provide guidance for future instruction. The contributions of the research for teaching practice in higher education have been discussed and several directions for future research have also been identified.

Appendices

Appendix A
Glossary of key terms

AOD contribution assessment	An assessment that uses graded discussion contributions. . These contributions are graded on quality not quantity of contributions, with short comments such as, “I agree”, excluded from assessment.
Assessed AOD	An online discussion that has a form of assessment associated with it.
Assessment rubric	A rubric used for summative assessment.
Asynchronous online discussion (AOD)	Text-based computer-mediated communication environment that allows individuals to interact with one another without the constraints of time and place (Hew et al., 2010).
Authentic	A learning task or activity with real-life contexts (Rovai, 2007).
Blended learning	Any combination of learning delivery methods, including most often traditional face-to-face instruction with asynchronous and/or synchronous computer technologies. Also called hybrid learning.
Collaborative learning	An instructional approach in which a small number of learners interact together and share their knowledge and skills in order to reach a specific learning goal (Hron & Friedrich, 2003)
Communication skills	The standard of writing within the postings on the online discussion forum, which show not only the writing skills of students but to a lesser extent their reading skills.
Computer-mediated communication (CMC)	The integrated use of telecommunications, computers and computer networks to provide new tools for teaching and learning. Characterised by asynchronous and synchronous communication capacity, high interactivity, and multi-way communication. Includes email and e-mail-based discussion lists, bulletin boards, computer conferencing environments, and other web-mediated human networks (Luppicini, 2007).
Contributions	The student transcripts of an AOD. Also called postings.
Course	A unit of study, generally the length of a semester. A number of courses make up a programme of study, such as Bachelor degree or a postgraduate degree. Some higher education institutions may use the word units instead, in which case, units make up a course of study such a degree.
Course objective	What an educator intends to achieve in the course of study

Critical thinking	See High order thinking. Defined for the research conducted in Study 2 as: The intellectually disciplined process of actively and skilfully applying, analysing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action (Scriven & Paul, 1987).
Discussion topic	The subject under discussion in an AOD forum. The discussion topic will often consist of a short paragraph explaining a concept, controversy or problem. This may be followed by a series of open-ended questions designed to stimulate student thinking about the subject to be researched and discussed. A set of readings may also be provided.
Distance education	Learning situation in which the teacher and learner are separated from each other and involved in a two-way interaction using technology to mediate the necessary communication (Oncu & Cakir, 2011).
Evaluation rubric	A rubric used for formative assessment.
Formative assessment	Assessment used to adapt teaching and learning to meet student needs.
High order thinking	High level thinking operations consisting of analysing, synthesizing and evaluating as defined in Bloom's Taxonomy (Bloom et al., 1956). Also called critical thinking.
Hybrid learning	See Blended learning.
Learning management system (LMS)	The online system employed at a university from which students can access information about the course and its related materials. The system also has a number of tools (assessment submission, online discussion, etc) for use in the course of study.
Learning outcome	A statement of what the learner is expected to know, understand or be able to do as a result of a learning process
Levels of thinking	A range of cognitive skills starting with knowledge, comprehension, application, and moving towards the higher skills of analysis, synthesis and evaluation (Bloom et al., 1956).
Low order thinking	Low level thinking operations consisting of remembering, understanding and applying as defined in Bloom's Taxonomy (Bloom et al., 1956)

Measured critical thinking skills	The total score obtained in an objective critical thinking test.
Moderation	Purposeful postings made to stimulate discussion if contributions cease, guide discussion in a particular direction, provide regular discussion summaries, or censor inappropriate comments. Moderation is often done by the instructor (or tutor/teaching assistant), or the task may be allocated to one or more students.
Participation	The posting of an online message during an asynchronous online discussion.
Perceived critical thinking knowledge	The self-reported level of knowledge about critical thinking including how critical thinking is learnt and developed.
Perceived critical thinking skills	The self-reported level of critical thinking, and includes skills used for analysis, interpretation, evaluation, synthesis and inductive and deductive reasoning
Post-AOD assessment	An assessment that uses a piece of work submitted after the completion of the AOD.
Postings	See Contributions.
Rubric	Document that describes varying levels of quality, with a mark often attached, for an assignment or task (Andrade, 2000; Ford, 2002).
Summative assessment	Assessment used for the purposes of grading that contributes to the final mark for a course.
Unit	See Course.

Appendix B
Comparative analysis of frameworks used in AOD research

In much of the research that examines the occurrence of thinking skills in AOD the most commonly used frameworks are the cognitive and metacognitive dimensions developed by Henri (1992), the Practical Inquiry Model (Garrison et al., 2001), Benjamin Bloom's Taxonomy of Educational Objectives for the Cognitive Domain (Bloom et al., 1956) and the Structure of the Observed Learning Outcome (SOLO) taxonomy (Biggs, 1979). These evaluative frameworks have provided the foundation for subsequent research in AOD where the employed framework has been used, built upon or adapted in some way (Corich et al., 2004; McKenzie & Murphy, 2000), or new evaluative frameworks created (for example, Bullen, 1997; Cheong & Cheung, 2008; Hara et al., 2000; Newman et al., 1995; Zhu, 2006).

Henri's (1992) seminal work applied the principles of cognitive theory in developing an analytical framework for identifying the cognitive operations exhibited in AOD. In creating the cognitive dimension, shown in Table B-1, Henri focused on the five reasoning skills associated with critical thought. Henri concluded that listing the cognitive skills alone was inadequate, as the learning process is influenced by the level at which information is processed, so added surface and in-depth processing indicators. A metacognitive dimension was subsequently added and defined in terms of its associated knowledge and skills.

Table B-1: Skills and definitions of the cognitive dimension (Henri, 1992)

Skills	Definitions
Elementary clarification	Observing or studying a problem identifying its elements, and observing their linkages in order to come to a basic understanding.
In-depth clarification	Analysing and understanding a problem to come to an understanding which sheds light on the values, beliefs, and assumptions which underlie the statement of the problem.
Inference	Induction and deduction, admitting or proposing an idea on the basis of its link with propositions already admitted as true.
Judgement	Making decisions, statements, appreciations, evaluations and criticisms. Sizing up.
Strategies	Proposing co-ordinated actions for the application of a solution, or for following through on a choice or a decision.

The Practical Inquiry Model (see Table B-2) developed by Garrison and colleagues (Garrison et al., 1999, 2001) represents the cognitive presence within their encompassing Community of Inquiry model. Critical thinking is defined as both a process, consisting of behaviour which online collaborators exhibit, and as a product, contributing to a deep understanding of some content, and as such critical thinking could be assessed by cognitive presence. The Practical Inquiry Model, based on a five-stage critical thinking process developed earlier by Garrison (1991), consists of four immutable phases: triggering event, exploration, integration and resolution. Each phase has example indicators representing 'the presence of a thinking process' or cognitive presence (Garrison et al., 1999). The first two phases have been classified into low level thinking while integration and resolution are considered high level thinking (Schrire, 2004).

Table B-2: The Practical Inquiry Model (based on Garrison et al. (2001) and McLoughlin and Mynard (2009))

Phases	Description
Triggering	Involves identification of an issue or problem, along with questions posed that stimulate discussion.
Exploration	Information is exchanged and the issue is explored in greater depth.
Integration	Ideas are connected and meaning is constructed.
Resolution	Issue/problem is resolved, with the application of the application of the proposed solution and the learner is aware of having acquired new knowledge and understanding.

Bloom's Taxonomy (1956) is a hierarchy of six thinking skills developed for use in educational research and curriculum development (see Table B-3). A revised version of Bloom's Taxonomy (Anderson & Krathwohl, 2001), where different types of knowledge related to the subject matter, are plotted against the associated thinking skills, has also seen some use in AOD (Christopher et al., 2004; Kay, 2006; Meyer, 2005).

Table B-3: Bloom's Taxonomy (Bloom et al., 1956)

Skills	Descriptions
Knowledge	The recall of specifics and universals, methods and process, patterns, structures or settings.
Comprehension	A knowledge of what is being communicated and can make use of the material or idea being communicated without necessarily relating it to other material or seeing its fullest implications.
Application	The use of abstractions in particular and concrete situations. The abstractions may be in the form of general ideas, rules of procedures or generalised methods, as well as technical principles, ideas, and theories which must be remembered and applied.
Analysis	The breakdown of a communication into its constituent elements such that the relative hierarchy of ideas is made clear and the relations between the ideas expressed are made explicit.
Synthesis	The putting together of elements and parts so as to form a whole. This involves the process of working with pieces, parts and elements to arrange and combine them in such a way as to constitute a pattern or structure not clearly there before.
Evaluation	Judgements about the value of material and methods for given purposes. Quantitative and qualitative judgements about the extent to which material and methods satisfy criteria. Use of a standard of appraisal.

The Structure of the Observed Learning Outcome (SOLO) taxonomy is a system for evaluating the products of learning by classifying student work according to its quality (Biggs, 1979; Biggs & Collis, 1982). The taxonomy has five levels that describe the possible learner responses to academic tasks: prestructual, unistructural, multistructural, relational, and extended abstract (see Table B-4). The first three levels have been taken to represent low level thinking, while the relational and extended abstract levels have been interpreted to represent high level thinking (Boulton-Lewis, 1998; Schrire, 2004).

Table B-4: Structure of the Observed Learning Outcome Taxonomy (Biggs, 1979)

Tasks	Descriptions
Prestructural	The task is not attacked appropriately, and the student has not understood the point.
Unistructural	One or a few aspects of the task are picked up and used.
Multi-structural	Several aspects of the task are learned but are treated separately.
Relational	The components are integrated into a coherent whole, with each part contributing to the overall meaning.
Extended abstract	The integrated whole at the relational level is reconceptualised at a higher level of abstraction, which enables generalization to a new topic or area.

Table B-5 lists the studies that have used one or more of the above evaluative thinking frameworks along with the study's targeted outcome. Researchers have chosen two ways to clarify the targeted outcome of their study: firstly the targeted outcome is descriptively defined (for example, Angeli et al., 2003; Bai, 2009; Duphorne & Gunawardena, 2005; Ertmer et al., 2011; Szabo & Schwartz, 2011), and secondly it is defined in terms of the particular framework used to evaluate the outcome (for example Christopher et al., 2004; Kay, 2006; Richardson & Ice, 2010; Schrire, 2004) . Angeli et al. (2003) equate critical thinking with "good quality thinking" (p. 32), while Bai (2009) simply states that "critical thinking happens in good discussions" (p. 2). Duphorne and Gunawardena (2005) describe critical thinking as a reflective, nonlinear process that can be developed in an online discussion environment and Ertmer et al. (2011) defined critical thinking as "…purposeful, reasoned, and goal-directed—the kind of thinking involved in solving problems formulating inferences, calculating likelihoods, and making decisions" (p.

6). Szabo and Schwartz (2011) associate critical thinking with the cognitive skills of logical reasoning, analysing arguments, testing hypotheses, making decisions, estimating likelihoods, and creative thinking.

In some instances, the description of the targeted outcome is somewhat ambiguous especially when critical thinking and higher order thinking are used interchangeably to define each other. For example, Fahy (2005) states that "critical thinking must be inferred by analysis of the 'traces' of higher-level cognitive activity found in transcripts" (p. 13) implying that critical thinking may be equated with higher-level cognitive tasks. Likewise Bradley et al. (2008) defined higher-order thinking as involving critical thinking skills which are in turn defined according to the levels of analysing, synthesising and evaluating found in Bloom's Taxonomy (1956).

The second way that a study's outcome may be defined is operationalising the targeted outcome in terms of the employed evaluative framework. McKenzie and Murphy (2000) evaluated critical thinking as established in Henri's cognitive dimension (1992), while Christopher et al. (2004) simply stated that Bloom's Taxonomy (1956) was used to measure the different levels of thinking. Likewise Kay (2006) describes cognitive processing as the combination of the knowledge and cognitive processing dimensions as described in the revised model of Bloom's Taxonomy (Krathwohl, 2002). In developing a learning model of the reasoning process, Aviv (2000) adopted the definitions suggested by Henri's (1992) cognitive dimension.

Table B-5: Thinking outcome terms and frameworks used in AOD research

Study's targeted outcome	Commonly used frameworks			
	Cognitive dimension (Henri, 1992)	Practical Inquiry Model (Garrison et al., 1999, 2001)	Bloom's Taxonomy (Anderson & Krathwohl, 2001; Bloom et al., 1956)	SOLO (Biggs, 1979; Biggs & Collis, 1982)
Critical thinking	Angeli et al. (2003); McKenzie and Murphy (2000)	Bai (2009); Richardson and Ice (2010); Corich et al. (2004)	Ertmer et al. (2011); Szabo and Schwartz (2011)	
Higher order thinking/reasoning	Ng and Murphy (2005)	McLoughlin and Mynard (2009); Schrire (2004); Schrire (2006) Meyer (2003)	Bradley et al. (2008); Schrire (2004); Schrire (2006)	Schrire (2004); Schrire (2006)
High level thinking			Christopher et al. (2004)	
High level cognitive activity/skills	Hara et al. (2000)	Fahy (2002) Fahy (2005)		
Higher levels of learning		Kanuka (2011)		Kanuka (2011)
Thinking levels		Meyer (2004)	Meyer (2004); Meyer (2005)	
Processing levels			Kay (2006),	
Meaningful discourse			Gilbert and Dabbagh (2005)	
Cognitive engagement/presence	Zhu (2006)	Darabi et al. (2011); Akyol and Garrison (2011)	Zhu (2006)	Thomas (2002)
Deep learning	Aviv (2000)			Slack, Beer, Armitt, and Green (2003)
Critical discourse		Kanuka et al. (2007)		

The plethora of terms used to describe high order thinking in AOD, the associated definitions and the variety of evaluation frameworks used suggest that there is very little consensus about thinking in AOD. Cosgrove (2011) and Hamann et al. (2012) both advocate that rather than stress the differences in conceptions of thinking a more useful approach may be to consider where agreement lies and instead, highlight the common elements. Adopting this approach two important conclusions may be drawn from the terms used in the studies listed in Table B-5. Firstly, we may conclude that the various outcome terms used to label high order thinking appear to describe very similar concepts, and secondly that the skills listed in the frameworks are likewise very similar. Each of these points is discussed in the following paragraphs.

McLoughlin and Luca (2000) cite the following commonalities in definitions of high order thinking: the capacity to go beyond the presented information, to evaluate and adopt a critical stance, and to develop metacognitive awareness and problem solving capacities. They also assert that becoming an autonomous thinker who is able to make reasoned judgements is the quality that most often emerges in the literature when discussing higher order thinking.

Bradley et al. (2008) and Szabo and Schwartz (2011) assert that generally speaking both higher-order thinking and critical thinking involve those cognitive processes of analysis, synthesis, and evaluation as described in the three uppermost levels of Bloom's Taxonomy (1956). Boulton-Lewis (1998) identifies high order thinking with critical thinking, while Ertmer et al. (2011) state that many authors use these terms synonymously.

The frameworks of Henri's (1992) cognitive dimension, the Practical Inquiry Model (Garrison et al., 1999), and Bullen's framework (1998) together with Garrison's 5-stages of critical thinking (1992) have been extensively compared with one another suggesting commonalities between them (see Table B-6). Marra et al. (2004) assert that the skills defined in the Practical Inquiry Model are similar to the skills described in Henri's cognitive dimension, and Newman et al. (1995) state that Garrison's 5-stage critical thinking model closely corresponds to the cognitive skills described in Henri's cognitive dimension. Both Garrison's 5-stage critical thinking model and Henri's cognitive dimension label their upper three categories of thinking as inference, judgement and strategies with similar definitions so this comparison seems very reasonable. Additionally, Garrison et al. (1999) state that the Practical Inquiry Model is a variation of his original critical thinking model, so despite the different labels used in the Practical Inquiry Model it may be concluded that both models have similar definitions and concepts.

Table B-6: Comparison of frameworks used in AOD studies according to Marra et al. (2004)

Henri (1992)	Practical Inquiry Model (2001)	Five-stage critical thinking Garrison (1992)	Bullen (1997)
		Identification: elementary clarification	
Elementary clarification		In-depth clarification	Clarification
In-depth clarification			
Inference	Trigger	Exploration: inference	Inference
Judgement	Exploration	Evaluation: judgement	Judging
Strategies	Resolution	Integration: strategy formation	Strategies

Schrire (2004, 2006) used Bloom's Taxonomy (1956), the Practical Inquiry Model and the SOLO (1982), and reported broad correspondences among the three measures as shown in Table B-7. Comparing Henri's (1992) cognitive dimension and the Practical Inquiry Model (1999) with the taxonomy of Bloom et al. (1956), there appears to be much agreement in the cognitive skills constituting high order thinking and critical thinking. Meyer (2004) has suggested that the upper levels of both the taxonomy of Bloom et al. and the Practical Inquiry Model evaluate similar high order thinking while Hara et al. (2000) have asserted that the skills of Bloom et al.'s Taxonomy is a direct match with the skills of the Henri's (1992) cognitive dimension (with the exception of the analysis level of Bloom et al.'s Taxonomy).

Table B-7: Comparison of frameworks according to Schrire (2004)

Practical inquiry model	Bloom's taxonomy	SOLO taxonomy
Exploration	Comprehension Application	Unistructural
	Preliminary analysis	Multistructural
Integration	Application Analysis Preliminary synthesis	Relational
Resolution	Synthesis	Relational
	Evaluation	Extended abstract

All these frameworks stress the complex cognitive skills involved in bringing together the relevant information, assessing its worth, considering differing perspectives, and evaluating proposed solutions. Skills such as reasoning, evaluating, analysing, judging, inferencing, conceptualising, synthesizing and reflecting appear common to most skill sets (Guiller et al., 2008). The descriptions of critical thinking discussed above likewise associate the concepts of analysing, synthesising and evaluating material with this type of thinking, and suggest that critical thinking involves reflection, is goal-oriented and seeks to identify and improve one's thinking.

Given the broad consensus on the concepts and skills involved in complex cognitive processing the terms high order thinking and critical thinking have been used synonymously in this thesis. Additionally, Bloom's taxonomy (1956) was used to specify the various thinking skills, with high order thinking skills represented in the upper levels of analysis, synthesis and evaluation, distinguishing it from low order thinking associated with those cognitive processes described in the lower levels of knowledge, comprehension and application.

Appendix C
Study 1 email inviting participation

Subject: School of IT (Murdoch University) PhD Survey

Dear Colleagues

I am a PhD student and lecturer at Murdoch University investigating the use of online resources, particularly online discussions. The purpose of this study is to investigate how asynchronous text-based online discussions are used in teaching, if you currently use or have used in the past a learning management system (eg. WebCT or similar), I would very much appreciate if you could find the time to complete this survey. If you have used online discussions the survey will take about 15 minutes to complete and if you have not used this tool then it will take about 5 mintues to complete the survey. This study will help in developing a model identifying the contributory factors resulting in successful learning outcomes.

Depending on the responses gained I may follow up the questionnaire with email communication in order to clarify and elaborate on some answers. The questionnaire therefore asks for your contact details, but supplying your details is entirely voluntary. Alternatively you may complete the questionnaire, but choose not to provide your contact details. All information given during the questionnaire is confidential and no names or other information that might identify you will be used in any publication arising from the research. The survey website will be used to present feedback on the study early next year (so you may like to bookmark the below link).

If you have any questions, comments or concerns about this questionnaire or the research, please feel free to contact Chris Klisc (9360 6697, C.Klisc@murdoch.edu.au) or either of my supervisors, Dr Tanya McGill (9360 2798, T.Mcgill@murdoch.edu.au) or Dr Val Hobbs (9360 2817, V.Hobbs@murdoch.edu.au).

If you are willing to participate in this study please click on the following link to open the questionnaire: www.it.murdoch.edu.au/~klisc/survey/survey.htm.

Thank you very kindly,
Chris Klisc

Appendix D
Study 1 questionnaire

Thank you for helping with this exploratory survey investigating the use of online discussions. Understanding how online discussions are currently used should result in guidelines for better outcomes which will benefit not only our students but provide teaching staff with assistance when planning their online discussions.

This website will be used to present feedback on the study early next year, so you may like to bookmark it.

Should you have any difficulties in responding please e-mail me at C.Klisc@murdoch.edu.au.

The first series of questions aims at finding out whether you use or have used online discussions in your teaching, and if you have used them, to indicate their purpose.

1.	How many years have you been using WebCT/Blackboard or similar type of software containing an online discussion tool?	

2.	Have you *ever* used an online discussion tool in your teaching?		
	○	No	Please go to Question 4
	○	Yes	

3.	What software have you used for your online discussion?		
	☐	WebCT	
	☐	Blackboard	
	☐	Other software - please specify:	
Please go to Question 5			

4.	Please provide some indication of why you have never used the online discussion tool in your teaching by ticking any number of the following:		
	☐	Not applicable for my teaching	
	☐	Unsure of how online discussions could be incorporated into my teaching	
	☐	Negative feedback from colleagues/students	
	☐	Other - please briefly describe	
As the remainder of this survey investigates the use of online discussion, you only need to complete the final set of questions, so please go to the final section.			

5.	Do you currently (either this year, or alternate years) use an online discussion tool in your teaching?		
	○	No	Please go to Question 6
	○	Yes	Please go to Question 7

6.	Please indicate why you no longer use an online discussion tool by ticking any number of the following:		
	☐	Not applicable to my current teaching	
	☐	Inappropriate postings and/or use by students	
	☐	Too time consuming to keep track of and read discussion threads	
	☐	Difficult to use for assessment purposes	
	☐	Other - please describe briefly	

As the remainder of this survey investigates the use of online discussion, you only need to complete the final set of questions, so please go to the final section.

7.	How many years have you been using online discussions?	

8.	Please list the unit/course codes and titles for which you have used online discussions during the last four years. Also provide the approximate enrolment number the last time this unit/course was run.:	

9.	Online discussions can be used in a variety of ways. Please tick any of the following which apply in your use of the online discussion tool:		
	☐	Information service about administrative unit/course matters (helpdesk type function)	
	☐	Forum for students to exchange information freely amongst themselves about any aspect of the unit/course	
	☐	Forum for discussion of assignments/assessments between students and instructors	
	☐	Feedback for students after completion of assessments	
	☐	Discussion of assigned topic(s)	
	☐	Other use - please describe:	

If you have indicated that the online discussion tool is used for discussion of assigned topics, then please proceed to Question 10, otherwise as the remainder of this survey investigates assigned topic online discussion, you only need to complete the final set of questions, so please go to the final section.

The following set of questions examines how you use the online discussion tool for assigned topic discussion and asks you to rate its success. For these questions, please use the **most recent unit/course** in which you employed online discussions for an assigned topic discussion (if you used online discussions in more than one unit/course at the same time, then please select the unit/course in which you found the online discussion to be the most successful).

10.	For this unit/course, please list its code and title, along with the number of students enrolled:	

11.	Please enter the country in which this unit was taught:	

12.	The most common format of an online discussion consists of a specified discussion topic with a series of open-ended statements and questions, along with a set of prescribed readings. Students have a limited time to research and make postings either from their reading and/or personal experience. Students are often recommended to refer to postings made by other students in their discussion. Did your online discussion take this format?		
	○	Yes	
	○	No - please briefly describe your format	

13.	Many instructors provide students with instructions regarding the online discussion. Tick as many of the following that you provided in your last unit:		
	☐	No instructions provided	

☐	Length of time the forum will be open for contributions	
☐	Number of required postings	
☐	How postings will be graded	
☐	Examples of graded contributions	
☐	Information on the purpose of using an online discussion tool. For example, the development of improved thinking skills, or the ability to synthesise material from several postings and draw suitable conclusions	
☐	Other - please briefly describe	

14.	Some instructors prepare students for the online discussion by having sessions which may address any of the following: how to approach the discussion topic, how to develop a persuasive argument through logic and evidence, or explain what is meant by critical thinking. Do you have any such preparatory sessions?	
○	No	
○	Yes - please briefly describe	

15.	How many separate discussion topics were used in your last unit/course?	

16.	For how many days, on average, was each topic open for discussion including weekend days?	

17.	Were students placed into groups (separate forums) for the discussion?	
○	No	
○	Yes - please enter the number of students in each group	

18.	Were students free to develop new threads within the discussion topic?
○	No
○	Yes

19.	Please enter the minimum number of postings required from each student? (If no minimum number, then please enter zero).	

20.	Discussion contributions may be assessed or evaluated, both assessed and evaluated or neither. Assessment means that the contributions are marked and graded, and are a component of the formal assessment for the unit. Evaluated means that discussion contributions are examined to determine the usefulness or relavancy of the discussion, but no formal mark is attached to the actual discussion contributions. Some instructors do not assess the discussion postings but use the contributions to form the basis for a followup assessment (eg. the submission of an individual report summarising the main points from the online discussion). Please tick all that apply:	
☐	The discussion contributions were neither assessed nor evaluated	
☐	The discussion contributions were evaluated (ie. feedback obtained but not assessed).	
☐	The discussion contributions were assessed	
☐	The discussion contributions form the basis for subsequent assessment. Please describe this subsequent assessment:	

The following questions ask you about moderation used in your online discussions.

Moderation may be defined as purposeful postings made to stimulate discussion if contributions cease, guide discussion in a particular direction, provide regular discussion summaries, or censor inappropriate comments. This moderation is often done by the instructor (or tutor/teaching assistant), or the task may be allocated to one or more students. Some instructors however choose not to get involved with the discussion process at all, instead relying on the group to moderate (this is known as group self-moderation). The following set of questions asks you to identify what activities form part of the moderation used in your discussions, who performs the moderation and the success of the moderation for each activity. In your last unit/course in which you used online discussion, if you used more than one form of moderation for a particular activity, then answer with the form of moderation that was used the most. If you did not use moderation at all, then choose the 'not applicable' alternative.

21.	Activity: ***Censorship regarding inappropriate postings.*** For this activity I have used mostly:	
	○ Instructor/tutor/teaching assistant moderation	
	○ Student moderation	
	○ Group self-moderation	
	○ Moderation not applicable	Please go to Question 23

		not successful						highly successful
22.	I have found this form of moderation to be:	○	○	○	○	○	○	○

23.	Activity: ***Rewording the original question when contributions are going off track.*** For this activity I have used mostly:	
	○ Instructor/tutor/teaching assistant moderation	
	○ Student moderation	
	○ Group self-moderation	
	○ Moderation not applicable	Please go to Question 25

		not successful						highly successful
24.	I have found this form of moderation to be:	○	○	○	○	○	○	○

25.	Activity: ***Additional comments to promote further discussion.*** For this activity I have used mostly:	
	○ Instructor/tutor/teaching assistant moderation	
	○ Student moderation	
	○ Group self-moderation	
	○ Moderation not applicable	Please go to Question 27

		not successful						highly successful
26.	I have found this form of moderation to be:	○	○	○	○	○	○	○

27.	Activity: ***Provide regular discussion summaries.*** For this activity I have used mostly:	
	○ Instructor/tutor/teaching assistant moderation	
	○ Student moderation	

	○	Group self-moderation	
	○	Moderation not applicable	Please go to Question 29

		not successful						highly successful
28.	I have found this form of moderation to be:	○	○	○	○	○	○	○

29.	Do you use moderation for an activity not listed above?	
	○ No	Please go to Question 33
	○ Yes	

30.	Please describe the activity:

31.	For the above activity I have used:
	○ Instructor/tutor/teaching assistant moderation
	○ Student moderation
	○ Group self-moderation

		not successful						highly successful
32.	I have found this form of moderation to be:	○	○	○	○	○	○	○

		contribution has been insignificant						contribution has been highly significant	Moderation not applicable
33.	Please indicate the extent to which you feel moderation overall has contributed to the success of the online discussion:	○	○	○	○	○	○	○	○

The following questions ask you about the success of your online discussions, and the amount of time involved in the complete management of online discussions.

34.	Please indicate the extent that online discussion has facilitated the achievement of the following aims:								
		not successful						highly successful	this was not a discussion aim
	Improved student communication skills	○	○	○	○	○	○	○	○
	Promoted more thought about the topic under discussion	○	○	○	○	○	○	○	○

	Increased student awareness of differing perspectives	○	○	○	○	○	○	○	○
	Enhanced deeper levels of student thinking	○	○	○	○	○	○	○	○
	Developed critical analysis and reflection in students	○	○	○	○	○	○	○	○
	Improved student learning through the collaborative construction of knowledge	○	○	○	○	○	○	○	○
	Promoted flexibility, by providing students the opportunity to participate regardless of time and location	○	○	○	○	○	○	○	○
	Allowed distance/external students to participate fully with all on-campus students	○	○	○	○	○	○	○	○
	Enabled me to be innovative in my teaching in a way not possible without online discussions	○	○	○	○	○	○	○	○

35.	In your last unit/course, on average, how much time did you spend on the complete management of your online discussion in a week (include every activity associated with the online discussion)?	
	Hours:	

36.	In your last unit/course, how much time did you spend on the preparation of the discussion topic/s?	
	Hours:	

37.	On average, how much time did you spend on moderation in a week in your last unit/course (if group self-moderation was used then please enter zero)?	
	Hours:	

38.	How many students did you moderate in this unit/course?	

39.	On average, how much time did you spend on marking discussion contributions in a week, in your last unit/course (if this was not marked then please enter zero)?	
	Hours:	

40.	For how many students did you mark their discussion contributions in this unit/course?	

This final set of questions aims at providing me with some background regarding yourselves, inviting you to comment on any aspect of online discussions, and, if you wish, to provide contact details for subsequent followup/study.

		little or no skill						very skilful
41.	How skilful do you consider yourself at using computers?	○	○	○	○	○	○	○

42.	Do you possess a teaching qualification?		
	○	No	
	○	Yes - please give the title of the qualification	

43.	How many years have you been teaching in tertiary education (include university/college, community college, TAFE/technical college or any other college of advanced education)?	

44.	How many years have you been teaching in schools (include both secondary/high school and primary/elementary sectors or equivalent)?	

		none						extremely intensive
45.	What level of training/professional development have you had in using software for online discussions?	○	○	○	○	○	○	○

		none						extremely intensive
46.	What level of training/professional development have you had in using online discussions in order to improve student learning outcomes?	○	○	○	○	○	○	○

47.	What gender are you?	○	Female	○	Male

48.	What is your age?		years

49.	If you would like to make any comments on any aspect of online discussions, especially if you have used something you have found particularly successful, please feel free to write your thoughts in the space below.

50.	Depending on the responses received from this questionnaire, I may wish to follow up this survey with future interviews/email correspondence. Would you be willing in participate in this?	
	○	No
	○	Yes

51.	I anticipate conducting a second study resulting from the findings of this questionnaire. Would you be willing in participate in this?	
	○	No
	○	Yes

52.	If you have ticked 'yes' to either questions 50 or 51, please provide your contact details below. If you choose not to provide your details then your completed survey will remain anonymous.					
	First Name		Last Name		Email Address	

Appendix E
Study 1 post-hoc analysis results of assessment approaches

The detailed results of the post-hoc analysis for the three different assessment approaches for each discussion outcome are listed below:

- *promoted more thought about the topic under discussion* showed a significant difference between no assessment and AOD contribution assessment (*Mdn* = 6.0 versus *Mdn* = 6.0, $p = .041$), as well as between no assessment and post-AOD assessment with or without AOD contribution assessment (*Mdn* = 6.0 versus *Mdn* = 7.0, $p = .001$),

- *increased student awareness of differing perspectives discussion* showed a significant difference between no assessment and AOD contribution assessment (*Mdn* = 5.0 versus *Mdn* = 6.0, $p = .011$), as well as between no assessment and post-AOD assessment with or without AOD contribution assessment (*Mdn* = 5.0 versus *Mdn* = 7.0, $p < .001$),

- *enhanced deeper levels of student thinking* showed significant differences between no assessment and AOD contribution assessment (*Mdn* = 5.0 versus *Mdn* = 6.0, $p = .006$), between no assessment and post-AOD assessment with or without AOD contribution assessment (*Mdn* = 5.0 versus *Mdn* = 7.0, $p < .001$), and between AOD contribution assessment and post-AOD

assessment with or without AOD contribution assessment (*Mdn* = 6.0 versus *Mdn* = 7.0, *p* = .031),

- *developed critical analysis and reflection in students* showed a significant difference between no assessment and AOD contribution assessment (*Mdn* = 4.5 versus *Mdn* = 6.0, *p* = .003), as well as between no assessment and post-AOD assessment with or without an AOD contribution assessment (*Mdn* = 4.5 versus *Mdn* = 6.0, *p* = .007),

- *improved student learning through the collaborative construction of knowledge* showed a significant difference between no assessment and post-AOD assessment with or without an AOD contribution assessment (*Mdn* = 5.0 versus *Mdn* = 7.0, *p* = .002),

- *improved student communication skills* showed a significant difference between no assessment and post-AOD assessment together with or without AOD contribution assessment (*Mdn* = 5.0 versus *Mdn* = 7.0, *p* = .042).

Appendix F
Study 2 project information

Research Project: A study of critical thinking and online discussions

Dear Student

We invite you to participate in a research project looking at critical thinking in the asynchronous online discussion environment.

Nature and Purpose of the Project

The development of critical thinking skills in students is an aim of most tertiary institutions. The ability to reason, think analytically and justify conclusions are regarded as essential skills for today's graduates.

The text-based nature of online discussion, along with its asynchronous response time, enables the combination of thinking and writing so necessary for the facilitation of critical thinking, and makes the development of critical thinking one of the most discussed potential benefits of asynchronous online discussion. It is important then that any form of assessment used in asynchronous online discussion should aim at measuring the development of this critical thinking in students.

I am currently doing my doctoral thesis and, under the supervision of Associate Professor Tanya McGill and Dr Val Hobbs, am investigating the use of online discussions to assist students develop their critical thinking. Research suggests that students need time to process the information from an online discussion and so having an assessment after the completion of the discussion may be a better indication of critical thinking in students than assessing the discussion postings. This project will help in determining this and so will assist in identifying effective assessment for students.

What the Project will Involve

I am inviting your participation in the project which will consist of the following components:

An initial perception questionnaire on critical thinking. The purpose of this is to measure your level of critical thinking as perceived by you. This will consist of a number of multiple choice type questions, as well as giving you the opportunity to enter more information if you want. It is estimated that the questionnaire will take no longer than 15 minutes.

A second perception questionnaire on critical thinking. The purpose of this is to measure your level of critical thinking, again as perceived by you after you have completed the discussion assessment/s. This will be largely identical to the initial perception questionnaire.

A critical thinking test. This will test your critical thinking by presenting a scenario about which you will be asked a number of questions. This test will be made up of multiple choice questions. It is estimated that this test will take no longer than 50 minutes.

The timeline for the project components and associated course assessments are shown in the below diagram:

Discussion A

Semester weeks	Week 1	Weeks 4-5	Friday week 7	Week 8	Week 9
Group 1	Perception Questionnaire	Online discussion of Topic A		Perception Questionnaire	Critical thinking test
Group 2	Perception Questionnaire	Online discussion of Topic A	Post-AOD essay	Perception Questionnaire	Critical thinking test

Discussion B (not part of the project)

Semester weeks	Weeks 10-11	Friday Week 13
Group 1	Online discussion of Topic B	Post-AOD essay
Group 2	Online discussion of Topic B	

The three project components will be completed online and I will post a notice on LMS when each component is available along with its link. Your participation in the project components is entirely voluntary and you can decide not to participate simply by not completing and submitting the components. I will also make an announcement in lecture informing you of the project component availability, and remind you that your completion of the component indicates your consent and its non-completion indicates you do not wish to participate or if you have participated before, non-completion now means you wish to withdraw from the project. So even if you commence participation in the project you can withdraw at any time by not completing any further components.

When completing the three project components you will be asked your name, however, all information given is confidential and no names or other information that might identify you will be used in any publication arising from the research. The school administration assistant will create a code number for you and match up the project components to this number. I will only have access to this number and will not know your name at any time regarding the project components.

Finally, in order to complete the project your results from the three project components will need to be matched to your results from either the online discussion or the reflection paper. I will need your consent to use your marks so that the school administration assistant can match your marks to your project components again using the code numbers created for you. I will not know at any stage who has participated in the project either from the project components or the assessment results. You will be asked for your consent to use the assessment marks, by replying to an email sent to you by the school administration assistant.

Your absence of reply to this email will indicate that you do not give consent to having your marks matched to the project components, and so your participation in the project will come to an end. Likewise if you wish to withdraw from the project after having granted consent to use your marks, you may email the administration assistant indicating your withdrawal without providing any explanation. Any information you have supplied up to withdrawal will be destroyed.

In appreciation of your time and effort involved in participating in the project you will receive two cinema tickets. At the conclusion of the project the school administration assistant will email you to say your cinema tickets are available for collecting.

Voluntary Participation and Withdrawal from the Research Project

Your participation in this project is entirely voluntary. You may withdraw at any time without discrimination or prejudice. All information is treated as confidential and no names or other details that might identify you will be used in any publication arising from the research. If you withdraw, all information you have provided will be destroyed.

If you consent to take part in this research project, it is important that you understand the purpose of the project and the procedures you will be asked to undergo. Please make sure that you ask any questions you may have, and that all your questions have been answered to your satisfaction before you agree to participate.

Benefits of the Project

Though there may be no direct benefit to you from participation in this project, your participation will help future students in developing their critical thinking and guide us, your lecturers, to provide better assessment for all students.

If you have any questions, comments or concerns about this project please feel free to contact me (9360 6697, C.Klisc@murdoch.edu.au) or either of my supervisors, Ass Prof Tanya McGill (9360 2798, T.Mcgill@murdoch.edu.au) or Dr Val Hobbs (9360 2817, V.Hobbs@murdoch.edu.au).

May I thank in advance those of you who will participate in the project, and those of you who decide not to participate, thank you for your consideration.

Kind regards

Chris Klisc

Appendix G
Study 2 interview invitations

Email interview invitation

Research Project: A study of critical thinking and online discussions

Dear Student,

I am sending the below email on behalf of Chris Klisc.

Dear Project Participant

I wish to thank you for your participation last semester in my research project, and I am now inviting you to participate in the next stage of this project which involves being interviewed to discuss your views about critical thinking and online discussions. The development of critical thinking skills in students is an aim of most tertiary institutions and the ability to reason, think analytically and justify conclusions are regarded as essential skills for today's graduates.

Nature and Purpose of the Project Interviews

You may recall that during semester 2 2010, you participated in an online discussion about privacy in social networking websites, and that you were assessed for this activity either by your discussion contributions or the submission of an essay. You also completed two perception surveys and a critical thinking test.

All project participant responses in the two perception surveys, critical thinking test and assessment items have now been examined. The purpose of this part of the project is to gain additional information about your views of critical thinking and learning using the online discussions.

You can help by agreeing to be interviewed. The interview will take approximately 45 minutes and can be arranged on campus (or other mutually favourable place), and you will be reimbursed for your time with a $20 gift voucher for the Myer Group retail outlet.

Your participation in this study is entirely voluntary. You may withdraw at any time without discrimination or prejudice. All information is treated as confidential and no names or other details that might identify you will be used in any publication arising from the research. If you withdraw, all information you have provided will be destroyed.

If you are happy to be contacted for participation in the interviews please forward this email to me (C.Klisc@murdoch.edu.au) and provide your contact information. I am no longer working at the university and so will be contacting the interviews myself.

Telephone interview invitation

Administration Assistant:

Hello (participant name), you may recall an email I sent recently about inviting you for an interview about the research project on critical thinking in which you participated last semester.

We have not received a reply from you and would to know if you would like to participate in a follow up interview?

Participant response:

Yes

An interview will then arranged by the administration assistant.

Participant response:

No

Administration Assistant:

Thank you very much then for your participation to date.

Appendix H
Study 2 pre-AOD questionnaire

Critical Thinking and Online Discussions

Dear Student,

Your participation in this survey implies that you agree with the below information:

1. I have read the Project Information handout about the nature and scope of this project. Any questions I have about the research process have been answered to my satisfaction.

2. I agree to take part in this research. By completing this online questionnaire I give my consent for the results to be used in the research.

3. I am aware that though I need to supply my name in this survey, this will be removed prior to using the information for analysis, and no identifying information will be passed onto the student researcher of this project.

4. I know that I may change my mind, withdraw my consent, and stop participating at any time.

4. I understand that all information provided is treated as confidential by the researchers and will not be released to a third party unless required to do so by law.

5. I understand that the findings of this study may be published and that no information which can specifically identify me will be published.

Thank you so much for participating!!

Critical Thinking and Online Discussions

*** 1. Your name and student number are required to match your survey answers to your discussion assessment. For more information refer to the Project Information handout.**

Student Identification Number

First Name

Last Name

For all of the following question statements, please choose ONE alternative to indicate your agreement/disagreement with the statement. When you have completed the survey click the Submit button at the end of the survey. You may return to a previous question if you want to change your response. However once you submit you will not be able to change any of your responses. If you do not wish to continue with the survey after you have commenced, then press 'cancel' and your responses will not be recorded.

Questions 1 - 19 ask for your opinion about your own critical thinking, and questions 20 - 25 ask what critical thinking means to you.

2. I use reasons and evidence to try and gain the best possible understanding of a given situation.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

3. I am tolerant of the opinions and ideas of others, especially when they are different from my own opinions and ideas.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Critical Thinking and Online Discussions

4. I carefully consider the possible outcomes or consequences of situations, choices, proposals or plans and to take this into account when making decisions.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

5. I solve problems in an orderly, organised way.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

6. I am confident in my reasoning and judgment to solve problems and reach my goals.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

7. I am curious and eager to learn/understand new things, even when I'm not sure how or why this learning might be useful.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Critical Thinking and Online Discussions

8. I do not see problems and situations as black or white, right or wrong.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

9. I recognise that there is often a number of ways to solve a problem or reach a goal.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

10. I understand the need to stand firm in my judgment when there is reason to do so, and to change my mind when reasons and evidence indicate that I am mistaken.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

11. I understand the idea that we sometimes need to make a decision or judgment even in the absence of complete knowledge or when there is no clear right or wrong answer.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Critical Thinking and Online Discussions

12. I am able to work out how true or false the inferences or conclusions are that someone draws from a particular set of information or data.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

13. I am able to work out what hidden assumptions have been made in a given statement.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

14. I am able to weigh evidence and decide whether generalisations or conclusions based on given data are warranted/justifiable.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

15. I am able to distinguish between strong, relevant arguments and arguments that are weak or irrelevant to a particular question or issue.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Critical Thinking and Online Discussions

16. I am able to critically evaluate academic writing (e.g., journal articles, books).

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

17. I am aware of what is needed to construct good arguments.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

18. I aware of the need to monitor, evaluate and adjust my own thinking processes.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

19. My critical thinking is at high stage of development.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Critical Thinking and Online Discussions

20. I have a clear understanding of the term 'critical thinking'.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

21. Critical thinking is closely related to reading and writing.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

22. Critical thinking is only developed and improved through practice and application of skills.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

23. I am aware of the skills involved in thinking critically.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

24. Critical thinking can be learnt easily.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Critical Thinking and Online Discussions

25. I am fully aware of what critical thinking is and now only need to put into practice what I have learnt.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Thank you for completing the survey!

Appendix I
Study 2 post-AOD questionnaire

Dear Student,

You have completed the online discussion, Discussion Topic A: Privacy in Social Networking Sites, and some of you have also completed the related essay. Though the below questions are very similar to the previous survey, this survey is trying to find out if you feel that the discussion and the essay (if completed) has helped to develop your critical thinking.

Your participation in this survey implies that you agree with the below information:

1. I have read the Project Information handout about the nature and scope of this project. Any questions I have about the research process have been answered to my satisfaction.

2. I agree to take part in this research. By completing this survey I give my consent for the results to be used in the research.

3. I am aware that though I need to supply my name in this survey, this will be removed prior to using the information for analysis, and no identifying information will be passed onto the student researcher of this project.

4. I know that I may change my mind, withdraw my consent, and stop participating at any time.

5. I understand that all information provided is treated as confidential by the researchers and will not be released to a third party unless required to do so by law.

6. I understand that the findings of this study may be published and that no information which can specifically identify me will be published.

Thank you so much for participating!!

* 1. Your name and student number are required to match your survey answers to your discussion assessment. For more information refer to the Project Information handout.

Student Identification Number

First Name

Last Name

For the following question statements, please choose ONE alternative to indicate your agreement/disagreement with the statement. Several questions ask for your feedback and provide a text box into which you can enter your response.

When you have completed the survey click the 'Submit your responses' button at the end of the survey. You may return to a previous question if you want to change your response. However once you submit you will not be able to change any of your responses. If you do not wish to continue with the survey after you have commenced, simply click on the link, 'Exit the survey' found in the top right corner and your responses will not be recorded.

2. I use reasons and evidence to try and gain the best possible understanding of a given situation.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

3. I am tolerant of the opinions and ideas of others, especially when they are different from my own opinions and ideas.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

4. I carefully consider the possible outcomes or consequences of situations, choices, proposals or plans and to take this into account when making decisions.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

5. I solve problems in an orderly, organised way.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

6. I am confident in my reasoning and judgment to solve problems and reach my goals.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

7. I am curious and eager to learn/understand new things, even when I'm not sure how or why this learning might be useful.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

8. I do not see problems and situations as black or white, right or wrong.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

9. I recognise that there is often a number of ways to solve a problem or reach a goal.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

10. I understand the need to stand firm in my judgment when there is reason to do so, and to change my mind when reasons and evidence indicate that I am mistaken.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

11. I understand the idea that we sometimes need to make a decision or judgment even in the absence of complete knowledge or when there is no clear right or wrong answer.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

12. I am able to work out how true or false the inferences or conclusions are that someone draws from a particular set of information or data.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

13. I am able to work out what hidden assumptions have been made in a given statement.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

14. I am able to weigh evidence and decide whether generalisations or conclusions based on given data are warranted/justifiable.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

15. I am able to distinguish between strong, relevant arguments and arguments that are weak or irrelevant to a particular question or issue.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

16. I am able to critically evaluate academic writing (e.g., journal articles, books).

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

17. Overall I feel that my critical thinking is continually developing.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

18. I am aware of what is needed to construct good arguments.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

19. I aware of the need to monitor, evaluate and adjust my own thinking processes.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

20. My critical thinking is at a high stage of development.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

Note: This item is number 19 in the pre-AOD questionnaire because item 17 in this questionnaire, was inadvertently omitted from the pre-AOD questionnaire. As a result of this discrepancy, all information supplied in item 17, in the pre-AOD questionnaire, was disregarded and excluded from any data analysis

21. I have a clear understanding of the term 'critical thinking'.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

22. Critical thinking is closely related to reading and writing.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

23. Critical thinking is only developed and improved through practice and application of skills.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

24. I am aware of the skills involved in thinking critically.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

25. Critical thinking can be easily learnt.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

26. I am fully aware of what critical thinking is and now only need to put into practice what I have learnt.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

27. For the Discussion Topic A:Privacy in Social Networking Sites, did you complete the essay?

- ◯ Yes - after clicking the Next button below you will directed to question 28
- ◯ No - after clicking the Next button below you will directed to question 32

28. I feel that the online discussion contributed towards developing my critical thinking skills.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

29. If you either 'Agree' or 'Strongly Agree' to the above question, please give several ways in which you believe the online discussion developed your critical thinking.

30. I feel that the process of researching and writing the essay contributed towards developing my critical thinking skills.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

31. If you either 'Agree' or 'Strongly Agree' to the above question, please give several ways in which you believe that the process of researching and writing the essay developed your critical thinking.

32. I feel that the online discussion contributed towards developing my critical thinking skills.

- ◯ Strongly Disagree
- ◯ Disagree
- ◯ Unsure/Undecided
- ◯ Agree
- ◯ Strongly Agree

33. If you either 'Agree' or 'Strongly Agree' to the above question, please give several ways in which you believe the online discussion developed your critical thinking.

Final question

34. Please add any comments about critical thinking, online discussions or essay writing, that you feel may assist with this research project.

Thank you for completing the survey!

Appendix J
Study 2 discussion A

ICT108 - Introduction to Multimedia and the Internet

Online Discussion Topic A – Privacy in Social Networking Sites (SNS)

All students, internal and external, have been allocated to one of six discussion forums on LMS. Forums 1, 2 and 3 are part of Group 1 and forums 4, 5 and 6 are part of Group 2. When you access the online discussion you will only have access to your own forum, which will be one of the following: Group 1 forum 1, Group 1 forum 2, Group 1 forum 3, Group 2 forum 4, Group 2 forum 5 and Group 2 forum 6. You will only see the forum to which you belong, not all the forums. If you cannot see one of these forums in the Discussion area please contact me asap.

All students will participate on the online discussion of Topic A Privacy in Social Networking Sites during weeks 6 and 7 (all forums are currently open). Those students in Group 1 (forums 1, 2 and 3) will have their discussion contributions assessed, while those students in Group 2 (forums 4, 5 and 6) will submit an essay to LMS. Group 1 students will have their discussion forums assessed and so the forums will be locked at the end of the fortnightly discussion period. Group 2 students will not have their forums locked, as they need to reference the discussion postings made by their forum members.

Date Due Group 1: 8pm Monday of week 8 (20th September) for the online discussion

Group 2: 8pm Friday of week 8 (24th September 2010) for the essay

Format

Group 1 Discussion Assessed

The discussion contributions should consist of content created by the student, but may include quotes (referenced) and links.

Group 2 Essay

The essay should be electronically created in a format compatible with Ms Word, and be no less than 1000 words (using the word count feature in any word processor). The essay should also have a bibliography but this is outside the above word count. The preferred reference style is APA. The assessment cover page (at the end of this document) should be copy and pasted at the beginning of the essay document and uploaded to LMS by the due date.

Unit Contribution 10%

Submission of Essay Upload to LMS

Aim To demonstrate your awareness and understanding of social issues surrounding the internet and the impact on our society.

Assessment Description

Your discussion/essay should address the following statement:

> *Describe the issues relating to privacy in social networking sites, and comment on how privacy issues may impact on the future of these sites.*

Things to think about:

What words in the topic need defining?

How does your technical background affect your views on internet privacy?

Can you imagine these sites still being around in ten years? How might these sites evolve?

Background to Privacy in Social Networking Sites

Recent research has found that many university students who use social networking sites such as Facebook may be leaving themselves vulnerable to all sorts of privacy issues by revealing personal information like birthdays, email addresses, street addresses, degree details, and intimate photographs. Privacy risks include tracking and collating information, where it can be relatively easy for government authorities to collect information from these sites and connect them to their own databases, thus allow profiling of its citizens. Likewise marketing partners of these sites can target their products to vulnerable consumers, and identity theft is always an issue.

Some recent cases (Anonymous, 2008):

- Enjoying her summer vacation, a hospital surgery nurse in Sweden checked her voice mail to find out that she was facing police charges and would likely be fired from the job for posting graphic images of brain surgery conducted at Karolinska University Hospital, where she worked. The 14 photos showed a back operation as well as brain surgery of patients whose identities were not visible. Photos in operating theatres for non-educational use are prohibited by hospital policy and its code of ethics.

- A college-age intern at Anglo Irish Bank in Massachusetts learned that there are no secrets on the Internet. He sent an email to his boss say- that he could not come to work on a day that happened to be Halloween 2007. The next day, his supervisor found a picture of the young man on his Facebook page, dressed in a tutu and drinking a light beer at a party the night before. The supervisor exposed the deception and the photograph to several colleagues at the bank, and later the whole email correspondence became hot reading on the blogosphere, not the kind of exposure an aspiring bank exec needs.

Readings

This is a brief list to get you started. There are many internet resources, but you should also use the journal databases on the library website as there is a lot of research being conducted in this area. Many of the below articles were sourced from Proquest and ACM Digital Library databases.

A report by the Economist:

http://www.economist.com/specialreports/displaystory.cfm?story_id=15350984

Anonymous. (2008). Horror Stories from Facebook. *Privacy Journal, 34*(11), 1.

Anonymous. (2009). Facebook Users Disregard Own Privacy to be Popular. *Privacy Journal, 35*(3), 3.

Bradley, T. (2009). Protect Your Privacy on Facebook and Twitter. *PC World, 27*(12), 110.

Gross, R., & Acquisti, A. (2005). *Information revelation and privacy in online social networks*. Paper presented at the Proceedings of the 2005 ACM workshop on Privacy in the electronic society.

Heffernan, V. (2009). Facebook Exodus. *New York Times Magazine*, 16.

Schrammel, J., Koffel, C., & Tscheligi, M. (2009). *How much do you tell?: information disclosure behaviour indifferent types of online communities*. Paper presented at the Proceedings of the fourth international conference on Communities and technologies.

Strater, K., & Lipford, H. R. (2008). *Strategies and struggles with privacy in an online social networking community*. Paper presented at the Proceedings of the 22nd British HCI Group Annual Conference on HCI 2008: People and Computers XXII: Culture, Creativity, Interaction - Volume 1.

Tune, C., & Degner, M. (2009). Blogging and Social Networking: Current Legal Issues. *Computer and Internet Lawyer, 26*(11), 1.

Young, A., L. , & Quan-Haase, A. (2009). *Information revelation and internet privacy concerns on social network sites: a case study of facebook*. Paper presented at the Proceedings of the fourth international conference on Communities and technologies.

Discussion Questions

During your online discussion you may consider the following questions useful in order to probe the issues behind the legislation:

What do you mean by…..?

Could you give an example?

Could you explain that further?

Why do you say that?

What was the purpose when you said….?

You seem to be assuming….?

What other information is needed?

Is there good evidence for believing this?

How does that information apply to this case?

You seem to be approaching this issue from….perspective. Why have you chosen this perspective?

What are you implying by that?

What effect would that have?

Would that necessarily happen, or only probably happen?

Can we break this question down at all?

Does this issue ask us to evaluate something?

How did you reach that conclusion?

Given all the facts, what is the best possible conclusion?

Marking Guide for Online Discussions (Group 1: forums 1, 2 and 3)

Both the quality of the contribution and the quantity of the contribution will be assessed. Spelling and grammar should be at the standard of being clear to the intentions of the writer.

Quality is assessed as follows:

A: Excellent input, demonstrates comprehension, takes debate into new areas, acknowledges other students' contributions, critiques readings or others' contributions constructively.

B: Attempt at involvement, not grasping issues, doesn't progress debate.

C: Does not demonstrate that discussions have been read, not much thought given to the topic, irrelevant or unhelpful post.

Quantity is assessed as follows:

Grade	*Minimum number of posts*
HD / D	4-5 x A
C	2 x A and 2 x B **or** 1 A and 4 B **or** 5 x B
P	6 x any combination of B/C quality
Not satisfactory	Anything not equal to the above

Marking Guide for the Essay (Group 2: forums 4, 5 and 6)

The essay must be at least 1000 words, excluding the bibliography. All content should be created by the student, and have at least 3 in-text references to the online discussion postings made by the forum members. Other in-text references are permitted by not mandatory. The essay should also have a reference list but this is outside the above word count. The preferred reference style is APA.

Marks will be allocated for: spelling, grammar and presentation, essay structure (introduction, body and conclusion) essay content, in-text references, and bibliography.

TurnItIn is available for students to check their essays for collusion/plagiarism issues. If the unit coordinator has concerns about any submitted essay, the submission will be submitted to TurnItIn.

APA referencing guide to a message posted to a newsgroup, online forum, or discussion group:

If the author's full name is available, list the last name first followed by initials. If only a screen name is available, use the screen name. Provide the exact date of the posting. Follow the date with the subject line of the message (also referred to as the "thread"); do not italicize it. Provide any identifier for the message in brackets after the title. Provide the address for the archived version of the message.

Example:

Chalmers, D. (2000, November 17). Seeing with sound [Msg 1].

Message posted to news://sci.psychology.consiousness,

archived at http://groups.google.com/group/sci.psychology.consciousness/

Example for our purposes:

Padovan, G. (2010, August 25). Re:Old Assignments [Msg 2].

Message posted to discussion/main/old assignments:
http://lms.murdoch.edu.au/webct/newMessageThread.dowebct?discussionaction=viewMessage&messageid=1456192464001&topicid=1420103718001&refreshPage=false&sourcePage=

Appendix K
Study 2 interview questions

Online discussion

What is your previous experience with online discussions?

What makes online discussions beneficial for you? What worked for you and what did not?

What do you think can be done in the online discussion to improve participation by other students?

Online discussions and the background reading can be very time consuming. Did this time factor affect your participation in the online discussions?

Online Discussion and Critical Thinking

How do you feel your critical thinking changed as a result of the online discussion?

How do you think the online discussion could be improved to assist with your critical thinking?

Essays

Those interviewees who had completed the essay assessment:

When doing the essay how did the online discussion help you with your essay preparation?

In what way, if any, do you feel that the essay helped with you critical thinking?

Those interviewees who had not completed the essay assessment:

Do you feel that essay writing the helps with your critical thinking? If so, in what way?

Critical Thinking

How would you define critical thinking?

What words or skills do you associate with critical thinking?

How can you recognise critical thinking in others? In their writing, or in conversation?

Do you ever think about how you think?

How do you think your thinking can be improved?

Critical Thinking Instruction

What prior instruction have you had on critical thinking?

What do you learn about critical thinking in your Foundation course?

Do you feel critical thinking can be taught indirectly or better to teach directly?

Would you like to have an introductory lesson on critical thinking held prior to an online discussion?

What would you like to see included in this ‘introduction to critical thinking”?

Appendix L
Study 2 interview consent

Research Project: A study of critical thinking and online discussions

I wish to thank you for your participation last semester in this research project.

You may recall that during semester 2 2010, you participated in an online discussion about privacy in social networking web sites, and that you were assessed for this activity either by your discussion contributions or the submission of an essay. You also completed two perception surveys and a critical thinking test. All project participant responses in the two perception surveys, critical thinking test and assessment items have now been examined, and the purpose of this part of the project is to gain additional information about your views of critical thinking and learning using online discussions.

Your participation in this study is entirely voluntary. You may withdraw at any time without discrimination or prejudice. All information is treated as confidential and no names or other details that might identify you will be used in any publication arising from the research. If you withdraw, all information you have provided will be destroyed.

Participant

I have read the participant information above and the Information Letter sent to me. The information has been explained to me and all my questions have been satisfactorily answered. I have been given a copy of the consent sheet to keep.

I am happy to be interviewed and understand that I can withdraw at any time without consequences to myself.

I understand that I do not have to answer particular questions and that I consent for the interview to be audio recorded by ticking the box below:

I give consent for the interview to be audio recorded ☐

I agree that research data gathered from the results of the study may be published provided my name or any identifying data is not used. I have also been informed that I may not receive any direct benefits from participating in this study.

I understand that all information provided by me is treated as confidential and will not be released by the researcher to a third party unless required to do so by law.

_____ _____

Signature of Participant Date

Investigator

I have fully explained to _____ the nature and purpose of the research, the procedures to be employed, and the possible risks involved. I have provided the participant with a copy of the Information Sheet.

_____ _____

Signature of Investigator Date

Student Researcher: Chris Klisc

Appendix M
An example of potential theme identification used in the interview analysis

Table M-1: A sample of comments relating to defining critical thinking with potential themes highlighted

multiple perspectives **deep thinking** **evidence and argument development** **knowledge** **questioning** **analyse**

The comments in this table are a sample of response to the question: How would you define critical thinking?

Participant ID	Participant quotes
1p	"I think of critical thinking in the sort of like I have an idea and some else has a different idea I am going to take whatever I find and sort of mould it into my own thing and talk about it"
1p	"the revision of knowledge of ideas and research and your ability to analytically think about things like that …to tell things apart and gather your own opinion and mix it with others"
1p	"critical thinking for me, definitely, about getting lots of different opinions and questions and all that and making your own thing and then say posting it on the discussion. And someone else can say well I don't think this at all. I think this and that whole sort back and forth"
2n	"its questioning, creating arguments for and against, and basically trying to find your opinion on the subject, to try and better yourself ."
2n	"I guess looking at the subject and seeing all sides of the argument and trying to determine the opinion you favour most or trying to find the truth behind the problem." "really don't have a good grasp of the concept yet"
2n	"looking at all sides, choose the best, and finding the truth behind the issue, and critique and questioning arguments and finding your stance on the subject"
3de	"Critical thinking to me is…not just looking at the top of the surface but looking below the surface and exploring different points of view."
4t	"analysing", "analysing the topic or the subject" "picking up points in the discussion…points that would support what you are thinking".
5a	"analysing something critically in detail" "beyond the surface layer" "looking for evidence to support a stance"
6da	"backup what they say with evidence, because a politician cannot just say 'we will raise inflation today' they have to critical think about what they do and back it up"
6da	"like a different kind of thinking process…like a deeper thought into the subject…like going beyond the initial layer"

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